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LUNG ABSCESS[1]

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THE thoracic surgeon, like any other physician who carries on a special type of medical practice, finds that he must have the constant co-operation and support of men occupied with other fields in medicine. The roentgenologist is one upon whom the thoracic surgeon must make frequent demands. The help obtained is more satisfactory if the contact is close and the exchange of ideas is free. Many difficult questions can in this way be solved that would otherwise be forced to await future development for their solution.

Because of our constant association with roentgenologists it is felt that it might be of advantage to record some of our experiences. We will try to point out some of the conditions we have encountered which have proven of value to us in arriving at our conclusion as early as possible.

DEFINITION

By lung abscess, we mean a destructive process in the lung tissue originating within the lung itself as a result of an invasion of the lung by pyogenic micro-organisms. All suppurative processes of the pleural cavity, such as empyema, whether general or local, and all tuberculous cavities are excluded.

ETIOLOGY

The one etiologic factor common to all lung abscesses is the propagation of pyogenic micro-organisms and their introduction into the lung substance. Any pus-forming micro-organisms, then, may be the etiologic or causative factor. All produce radiological evidence of much the same character. We have noted that lung abscesses produced by certain micro-organisms present some features in a more striking manner than others; for instance, abscesses caused by fuso-spirochetal organisms of Vincent are prone to spread rapidly without regard to fascial planes or lobar boundaries (Case I) and are associated with a foul odor, while abscesses caused by *B. Friedländer* may spread less rapidly—they seem to excavate the lung.

While all lung abscesses present radiological evidence of much the same character, there is, however, such a wide range of findings at different stages in the development of lung abscesses that it is not surprising that difficulty is at times encountered in the diagnosis of such processes. A considerable proportion of the lung abscesses encountered is found to follow some known condition. In certain types of abscesses, *i.e.*, post-ton-

[1]In this issue will be found a group of papers by members of the Staff of Grace Hospital, Detroit.

sillectomic, it is possible to definitely establish the date of the onset. Should one follow such a complication through all of its phases one would be able to obtain certain evidence of value.

ROENTGEN EVIDENCE

At the onset of a lung abscess, the formation of which is due to aspiration, infection, and blockage of secretion, the first roentgenographic evidence of abscess-formation is the appearance of an area of increased density in the region of the bronchial obstruction. This area of increased density is confined at first to that portion of the lung immediately adjacent to the obstruction and along the bronchial tree distal to the obstruction. The markings of the bronchi distal to the obstruction most frequently appear as radiating lines extending into the periphery of the lung field (Cases II and III). Succeeding studies show extension of the area of increased density until, in time, an entire lobe or more may be involved in the process (Case IV). The speed with which the lesion extends depends upon the virulence of the infecting organisms and upon the interference with endobronchial drainage. As the density of the involved portions of the lung increases, the usual lung markings become obliterated, even the peribronchial radiations being lost in a shadow of uniform density (Case IV). Later, areas of decreased density may appear in this shadow of uniform density. These may be circular or irregular in outline; they may be single or multiple. It may also be noted that at the most dependent portion of these areas of decreased density the outline is horizontal, resembling a fluid level. Such areas can usually be interpreted as areas of destruction or cavitation, and in cases in which a horizontal line represents the most dependent portion of the rarefied area one is usually safe in interpreting such a finding as a fluid level (Cases V and VI).

Abscess cavities are rarely surrounded by recognizable capsules, but appear, rather, as defects within boundaries of uniform density which surround them (Case VI). Cavities which have attained a moderate size practically always communicate with a bronchus. The free access of air causes their fluid contents to assume a horizontal level, which is surmounted by a hemispherical air space. Such a horizontal level, which can be caused to shift by a change of position, is so characteristic of an accumulation of fluid with air superimposed, that it constitutes positive evidence of a cavity, even when, as frequently happens, the walls of the latter are indistinct or invisible. Cavities vary in size from some which are barely distinguishable (Case VIII, Fig. 2) to others which occupy a whole lobe (Case VI). This entire picture, from the very slightest increase in density of the pulmonary shadows to the changes indicative of cavity formation with fluid, may be seen to develop during a matter of from one to two weeks.

At times the roentgenologist must vary his procedure in order to detect cavities which are located in unusual situations. In Case VII is illustrated an irregular cavity which lies within a diseased right lower lobe. It was necessary to resort to the oblique position in order to disclose this cavity at its best, as it was partially obscured by the heart in the dorsoventral position. The same difficulty was encountered to a lesser degree in another case of lower lobe abscess on the right side. Here again, the cavity was partly hidden by the right ventricle in such a way that the evidence of its presence was not detected and doubt arose as to the nature of the patient's illness (Case XII).

LOCATION OF THE ABSCESS

The exact localization of the abscess, which we owe in such full measure to the roentgen examination, has a practical bearing which transcends its value as a mere

method of diagnosis. To the surgeon who contemplates the drainage of a cavity or the incision of a lobe, or to the endoscopist, the situation of the abscess will determine his method of approach, and for this purpose an accurate localization is essential. Even with the roentgen examination, this is not always possible. Especially on the right side, the overlapping of the three lobes in the middle third of the chest will render it difficult to assign an infiltration in this region to any one lobe or to the adjacent portions of all three lobes. Here stereoscopic examination may be of service. In Case VI, for example, it is impossible to deduce, from the plate alone, whether the abscess is situated in one or more lobes; at bronchoscopy it was found that drainage occurred by way of the middle and lower lobe bronchi. In these cases, dependence must be placed on the location of the physical signs and bronchoscopic findings to distinguish between an affection of the lower part of the upper lobe and upper part of the lower lobe, the shadows of which will be superimposed on the plate. The findings at endoscopic examination are most dependable. The endoscopist is able to identify the bronchus from which the drainage takes place, thereby determining the portion of the lung involved, unless the process has involved one lobe of lung and ruptured through an interlobar fissure to establish drainage through the bronchus of an adjacent lobe. Some would hesitate to make a diagnosis of lung abscess during that stage when the first area of increased density appears (Cases II and III), preferring to await the time when an area of destruction has developed and a definite fluid level has presented itself, as in Case VI.

Experience has shown us that a fluid level may not reveal itself when frank abscess formation has taken place. Frequently, cavities which are full of secretion, especially when they are small, may be entirely obscured by the increased density of the lung about them (Case VIII). Then, too, liquefaction can take place without the presence of sufficient gas or air to denote a fluid line. The presence of a fluid level in an area of increased density in a lung field usually indicates the presence of a communication between the space containing the fluid and the tracheobronchial tree. We have seen cases which failed to show such a fluid level, present a fluid level immediately after the institution of endobronchial drainage (Case IX). Certainly the abscess was present previous to the drainage and the diagnosis would have been of greater value could the development of the cavity have been anticipated and the diagnosis of an impending abscess have been made. We are cognizant of the fact that the roentgenologist would require certain clinical information before making such a diagnosis, but we know of no reason why he should not be permitted to profit by all available information in the hands of the clinician in arriving at a conclusion.

It is obvious that the radiologist will be aided materially in his diagnosis of impending abscess if he makes frequent roentgen-ray examinations, even daily, during the period of study. It is not sufficient, however, to merely make X-ray plates and send the patient back to his room—a fluoroscopic study should also be made. Frequently one finds that areas of altered lung markings can be brought out more satisfactorily in the X-ray plates, if at first the proper angle is selected during a fluoroscopic examination. In addition, the mobility of the various contents of the thoracic cage can best be studied by fluoroscopy.

DIFFERENTIAL DIAGNOSIS

Lobar Pneumonia.—In the acute stage of a developing lung abscess the consolidation may develop in the hilum region, as in lobar pneumonia. A second plate at the end of twenty-four hours or even a third after forty-eight hours should serve to differen-

tiate the lesion, inasmuch as the consolidation in lobar pneumonia is usually much more rapid in its development than in the lung abscess.

Massive and Localized Atelectasia.—The differentiation of an acute lung abscess from a massive atelectasia or a localized atelectasia may be somewhat difficult. However, in the classical picture of massive atelectasia, the characteristic findings (Case X) of a narrow hemithorax, with an increased density of the involved portion of the lung and the narrow interspaces, with the displacement of the mediastinal contents, *i.e.*, heart and trachea, toward the involved side, and the elevation of the diaphragm, serve as differential points to contrast with those previously described in the case of a lung abscess. In case of a localized atelectasia the classical roentgen-ray findings may not all be present. If, however, the roentgen studies have been made shortly after the onset of the atelectasia, there is always some evidence of fixation, elevation of the diaphragm, or of contraction of the interspaces, with some displacement of the mediastinum. These findings may at times be seen at their best under the fluoroscope. It must be borne in mind that many post-operative lung abscesses develop in areas that were in the beginning merely areas of atelectasia, and that relief from the bronchial obstruction in many instances prevents abscess formation.

Empyemas are also at times confused with acute lung abscesses. If, however, the empyema is located adjacent to the mediastinum, there will be displacement of the mediastinal contents toward the good side (Cases XI and XII), in contrast to no displacement of these structures, as in lung abscess. If the abscess is located in the peripheral portion of the lung or there is an intralobar empyema on the right especially, the free use of the fluoroscope with the patient turned so as to bring the diseased area into view from all angles will be of aid. It may not be possible to make a fixed differential diagnosis by means of the X-ray alone (Case XIII).

Chronic lung abscess cannot be entirely differentiated from chronic tuberculosis, with cavity, by X-ray examination alone. (Compare Case VII and Case XIV.)

A carcinoma of the lung may become secondarily infected and an acute abscess may develop if studies have been made previous to the development of the abscess. Comparison may render the differential diagnosis much easier.

A chronic lung abscess can be differentiated from chronic bronchiectasia by X-ray studies, such studies being rendered more valuable by the use of lipiodol as a contrast medium. In certain instances a lung abscess which fails to be revealed by the ordinary plates can best be shown by the use of lipiodol injected through a bronchoscope. (See Cases VII and XV.)

Lung abscesses secondary to a foreign body, even those foreign bodies of metallic nature, are overlooked at times because of the failure of the physician to make use of the X-ray or because of improper roentgen-ray technic, when, on the other hand, a properly taken X-ray plate would point the way to the proper diagnosis and treatment of the case (Case XVI).

ROENTGENOLOGICAL AID IN TREATMENT

The part played by roentgenography in the treatment of lung abscess does not end with the diagnosis. Since the position and character of an abscess is a factor in determining the type of treatment to be instituted, the roentgen evidence becomes of utmost importance as a check on the efficacy of whatever line of treatment is instituted. It is a well known fact that a certain percentage of lung abscesses will heal without undue delay, following rupture of the abscess, with evacuation of its contents through a bronchus. Roentgen-ray studies are the means of making permanent records

for comparison of the condition at varying stages in the healing process. Only too often it happens that the physical signs may entirely disappear, temperature and sputum may disappear, and the patient may feel so well that a remaining focus will not be suspected. Roentgenographic studies may disclose a focus, and, so long as such a focus remains, it is a potential source of danger for further inoculation and spread of the disease. Cases VI, XVII, and XVIII illustrate instances which have been followed with X-ray studies. All these patients are now well.

We have always maintained that the one principle which must be strictly adhered to in the treatment of lung abscess, regardless of the method used to obtain drainage, is that of efficient drainage. Needless to say, the more conservative the measures used the more desirable they become, provided the method is efficient. Physical signs and clinical observations serve to give some indication as to the efficiency of the drainage established, but it remains for roentgenographic examinations to pronounce the final word as to the efficiency of the method used and as to the desirability of discontinuing treatment. The roentgen studies enable one to correct defects in the posture selected for postural drainage. Bronchoscopic dilatations and aspirations can be carried out more efficiently if frequent roentgen studies are made to determine the rate of disappearance of the fluid level and pneumonitis and the closure of abscess cavities.

While it is true that a certain percentage of lung abscesses will heal without treatment other than postural drainage, it is too often the case that an abscess is permitted to go without other treatment until its walls have become indurated and much time has been lost. Many such abscesses require open surgical drainage (Cases XVIII and XIX), with its accompanying high rates of mortality and deformity. We have noted, however, that a much smaller number of lung abscesses require open drainage when they are followed closely by roentgen-ray studies at the same time that postural drainage and bronchoscopic drainage are being used. In fact, by combining posture and bronchoscopic drainage with careful roentgen-ray studies a very large percentage of lung abscesses can be cured without resorting to more radical measures. In making these suggestions we are not overlooking the fact that approximately 50 per cent of acute lung abscesses heal without any form of treatment. We feel, however, that the important thing is for us to strive to raise our percentage of healed abscesses from 50 per cent to as near 100 per cent as possible, without the aid of radical measures, if possible, and endoscopy in our experience has proven to be the most valuable aid at our command. We are better enabled to avoid the chronic lung abscesses which require months to heal by applying endoscopic methods of drainage as soon as we are able to make a diagnosis of impending lung abscess.

We realize that in many quarters the roentgenologist is expected to merely make a diagnosis from his X-ray films, in many instances without the aid of clinical evidence. From a considerable experience in the treatment of suppurative lesions of the lung, we have arrived at the point where we expect our roentgenologist not only to make a diagnosis, but we feel that he must go further, inasmuch as in many instances he will see the case earlier than the thoracic surgeon—we feel that he should make suggestions as to the probable necessity of intervention. He should call to the attention of the referring physician such findings as suggest the need of endoscopy early, so as to enable the patient to avoid the more severe complications and the more drastic measures that might be required at a later date.

The medical treatment of acute pulmonary suppuration is expectant and in reality no specific drug can be recommended. In the

Fig. 1. Case I.

Fig. 2. Case I.

adoption of expectant treatment and the attempt to evacuate the cavity by way of the bronchi without resort to more active measures, it is to be appreciated that there is the risk of extension of the suppurative process into nearby or remote parts of the lung, the development of a complicating pneumonia, empyema, cerebral abscess, or septicemia, and that in consequence of delay the local or general condition may become less rather than more favorable for the application of other methods of treatment.

It is not an everyday occurrence for the general practitioner to encounter a lung abscess and one must not censure him too severely if he does not resort to endoscopy or some conservative method of active treatment at an early date. On the other hand, the roentgenologist will see numerous cases, and if he has acquainted himself with the progress of other cases that have passed through his hands, he can with all sincerity advise intervention or at least consultation as to the advisability of intervening.

The fact that some cavities heal spontaneously is not sufficient to warrant any man following a program of watchful waiting. The calamities will so far outweigh the successes that one can no more find justification for such delay than one could find justification for such a course in the average case of acute appendicitis.

One might summarize these experiences in the following manner:

(1) The roentgenologist is an important and necessary link in the personnel handling lung abscesses; he should make use of all clinical information available in arriving at his diagnosis.

(2) The roentgenologist should do more than arrive at a diagnosis; he should make suggestions in regard to probable need of treatment.

(3) The roentgenologist should follow his cases to learn the ultimate results.

(4) It is desirable to make a diagnosis of impending lung abscess rather than to wait for a full-blown abscess to develop before making a diagnosis.

(5) In our experience, conservative active methods of treating lung abscess have been the most satisfactory.

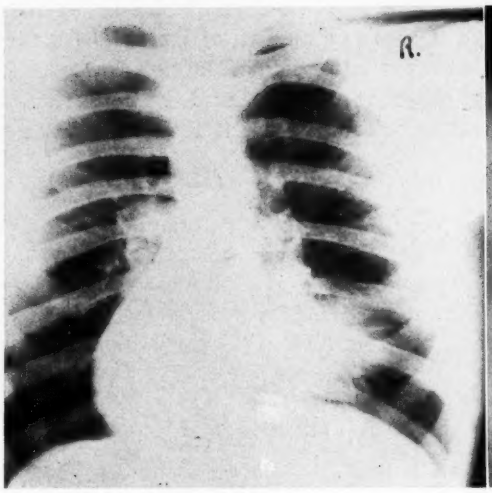


Fig. 3. Case II.

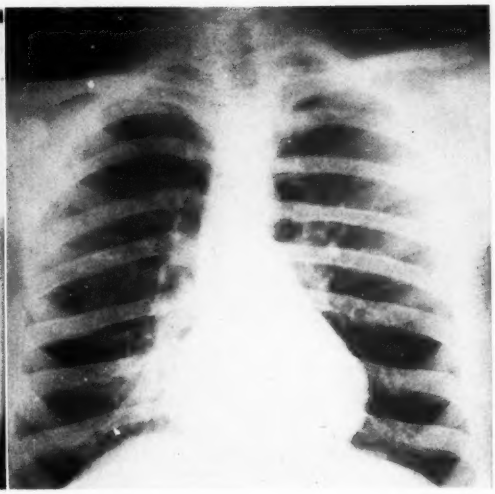


Fig. 4. Case II.

CASE REPORTS

Case I.—This patient was a white male about 45 years of age, who gave a history of having had all of his teeth extracted under gas anesthesia one week previous to his admission to the hospital. At that time he was very ill, and was coughing up large amounts of very foul sputum which contained many organisms, including the fusospirochetal organisms of Vincent. X-ray studies revealed extensive areas of increased density throughout the right lung field and at postmortem it was found that the right lower and middle lobes were fused across the interlobar fissure by a plastic exudate (Fig. 1), and on section (Fig. 2) it was noted that there was extensive excavation extending directly across the region of the interlobar fissure.

Case II.—This patient is a white male 20 years of age, who had had some teeth extracted ten days previous to this X-ray examination (Fig. 3). Within the first week after the extraction he developed a nonproductive cough and a low grade temperature, with marked malaise. The X-ray studies show an area of increased density in the medial portion of the right lower lobe, with radiating lines extending toward the periphery. The diagnosis was obstruction to a division of the right lower lobe bronchus. Bronchoscopy was done and a plug was removed from a medio-posterior division of the right lower lobe bronchus. Microscopic

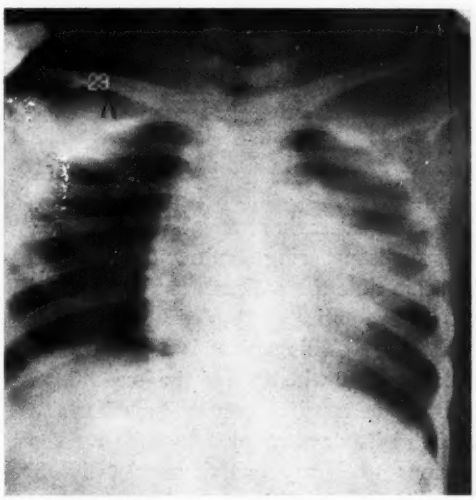


Fig. 5. Case III.

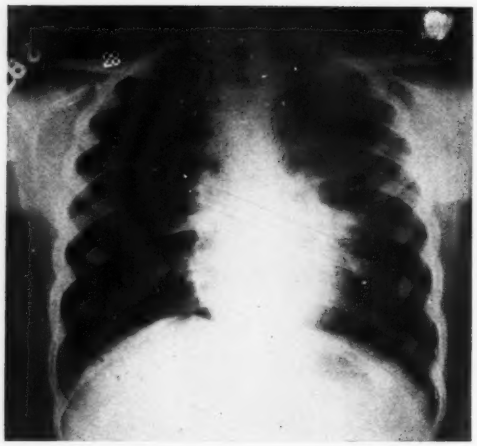


Fig. 6. Case III.

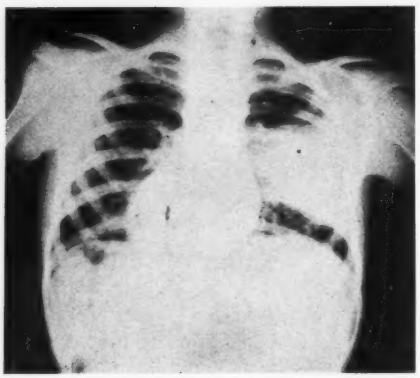


Fig. 7. Case IV.

examination proved this to be a piece of peridental membrane. Cultures revealed virulent long chain streptococcus. A second film, made within forty-eight hours after bronchoscopic removal of the plug, reveals a disappearing shadow (Fig. 4). At the same time the patient's temperature and cough have entirely subsided.

Case III.—This patient is a white female 8 years of age who entered the hospital with a history of tonsillectomy under ether anesthesia eight days previously and five days previous to X-ray examination (Fig. 5). Following the tonsillectomy there developed malaise, temperature, and a non-productive cough. It was noted that in the X-ray film there was seen an area of increased density in the medial portion of the right lower lobe, adjacent to and confluent with the heart shadow. Temperature at this time was 105°.

Fig. 8. Case IV.

A diagnosis of an impending lung abscess, due to bronchial plug, was made. Bronchoscopy was done. A plug of mucus and old blood was removed from the right lower lobe bronchus. A virulent short chain streptococcus was obtained on culture. Immediately, the condition improved, the temperature reached normal within twelve hours, and did not rise again above 99°. The X-ray film (Fig. 6) at the end of twenty-four hours reveals a clearing of the area of increased density, with the reappearance of the right heart shadow.

Case IV.—This patient is a white male 7 years of age who underwent the operation of tonsillectomy four months previous to the present illness. Ether anesthesia was used and the anesthetic was said to have been administered with difficulty. Within two weeks after the tonsillectomy the patient developed a cough (non-productive), malaise, and a temperature which ranged from 99° to 103°. He lost a great deal of weight. X-

Fig. 9. Case V.

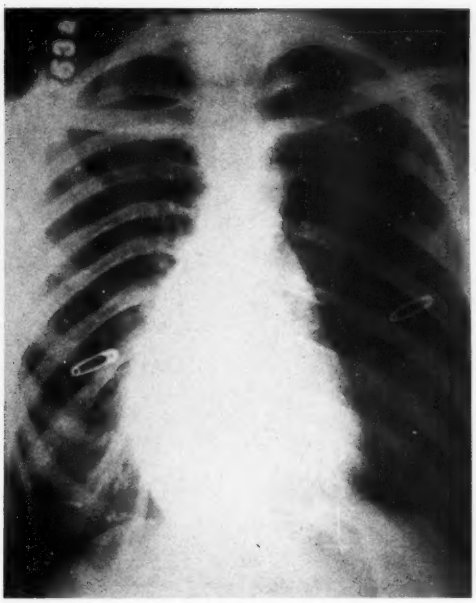


Fig. 10. Case V.

ray studies (Fig. 7) reveal an area of markedly increased density in the region of the right middle lobe and the lower portion of the upper lobe. The lateral view (Fig. 8) reveals a similar density in the region of the middle lobe. Open drainage was performed and an extensive lung abscess opened up which involved the lower half of the right upper, the entire right middle, and the upper part of the right lower lobe. Cultures revealed a staphylococcus. The patient, now at the end of six years, remains in good health.

Case V.—This patient is a white female 24 years of age, with a history of a tonsillectomy under ether anesthesia two weeks before the present examination. Following the tonsillectomy she developed a cough, non-productive at first, but becoming productive of foul sputum and accompanied by temperature, loss of appetite, together with general malaise. There was severe pain over the right lower chest posterolaterally. X-ray examination (Fig. 9) reveals an area of increased density in the lower medial portion of the right lower lobe, together with a punched-out area of decreased density which has a straight line for its most dependent border. It is to be noted that there is no definite wall or capsule about this area of decreased density, which simply occurs in the middle of an area of otherwise equal density. Attention should be directed, also, to the deformity of the spine. Diagnosis of lung abscess was made. Bronchoscopic aspirations were done and in the follow-up plate (Fig. 10) it is to be noted that the area of increased density, at the right base, has entirely disappeared and that there no longer remains any evidence of the punched-out area seen in the first studies. Instead, there appear, now, normal lung markings. Meanwhile the patient's physical signs, temperature and cough, have entirely disappeared.

It is to be noted that the clinical course in the case of this patient was prolonged over

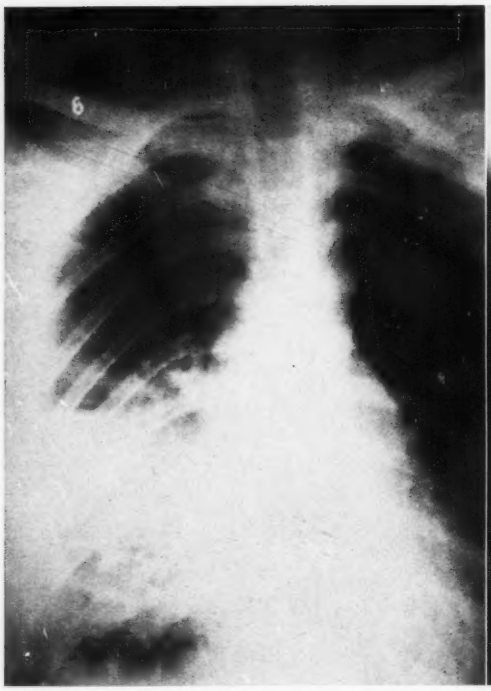


Fig. 11. Case VI.

Fig. 12. Case VI.

that of Cases II and III, the latter two requiring only one bronchoscopic drainage each, while this patient required drainages three times a week for the first three weeks in order to maintain continuous drainage.

Case VI.—This patient is a white male 27 years of age. There is a history of an indefinite onset of a "flu" or grippe-like character with the gradual appearance of productive cough. X-ray studies (Fig. 11) reveal an area of increased density in the region of the right lower and middle lobes of the lung. There is shown in this area of otherwise uniform density an irregularly punched-out area of decreased density, and in an X-ray film (Fig. 11) taken in the postero-anterior position, the patient in the upright position, there is a horizontal line at the most dependent portion of the punched-out area. With the patient lying on his left side (Fig. 12) there is a shifting of this line so that it lies parallel with the spine. With the patient in the upright position, in the lateral view (Fig. 13), again an irregular punched-out area of decreased density appears, which occupies a considerable portion of the chest at this point, and the horizontal line is seen in a new position. A diagnosis of extensive lung abscess was made. Repeated bronchoscopic drainages were carried out, with entirely satisfactory results.

Figure 14 shows the scar that remains at the end of three months, as seen in a postero-anterior film, while Figure 15 shows the same in a lateral view. The enormous size of this cavity, and the prolonged and energetic treatment that was necessary, as compared with the story told by Figures 12 and 13, merely serve to emphasize the importance of an early diagnosis with early treatment in a developing suppurating lesion.

Case VII.—This patient is a white male

Fig. 13. Case VI.

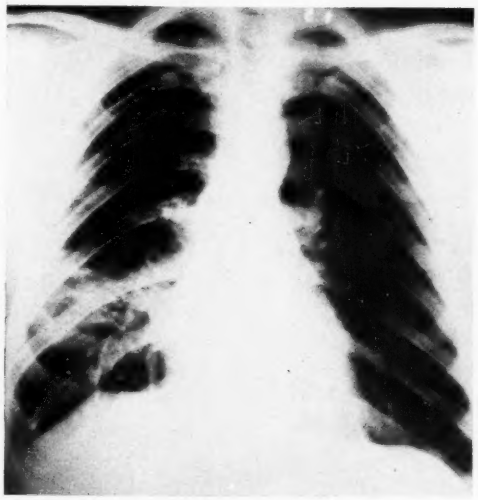


Fig. 14. Case VI.

47 years of age, who gives a history of repeated pulmonary hemorrhages at frequent intervals over a period of twenty years. Repeated X-ray examinations have failed to reveal anything of diagnostic importance. Physical examinations revealed nothing definite in the chest. Bronchoscopy was done

Fig. 15. Case VI.

and a small cavity was identified at the root of the right lung, off from the first portion of the lower lobe bronchus. This cavity was filled with lipiodol and plates made in the postero-anterior position (Fig. 16) and in the oblique position (Fig. 17). Diagnosis: Chronic lung abscess, right lower lobe, probably due to rupture of a suppurating lymph gland.

Case VIII.—This patient is a white female about 35 years of age with a history of a cough which developed following an illness of grippe-like character eight weeks previous to the present examination. Associated with the cough are malaise and a temperature up to 103°. X-ray studies in the postero-anterior position (Fig. 18) reveal an area of uniformly increased density in the left upper lobe. Because of the location of this lesion pulmonary tuberculosis

was considered, but repeated sputum examinations were negative for acid-fast organisms. A diagnosis of impending lung abscess was made and bronchoscopy performed. X-ray plates taken in the same position (Fig. 19) following bronchoscopy show a definite decrease in the extent of the area of increased density and also reveal a punched-out area of decreased density. A third X-ray film (Fig. 20) within six weeks reveals disappearance of all evidence of the former lesion, and the patient has remained well since.

Case IX.—This patient is a white female 32 years of age who entered the hospital with a history of a cough, which developed following delivery under gas anesthesia two weeks previously. X-ray films taken in the postero-anterior position (Fig. 21) at the end of twelve days reveal an area of in-

Fig. 16. Case VII.

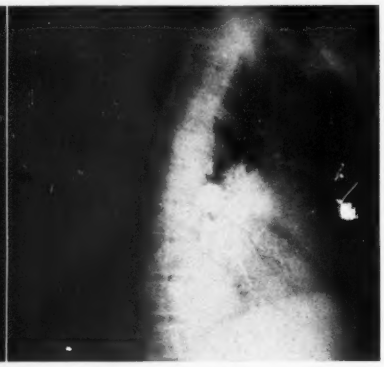


Fig. 17. Case VII.

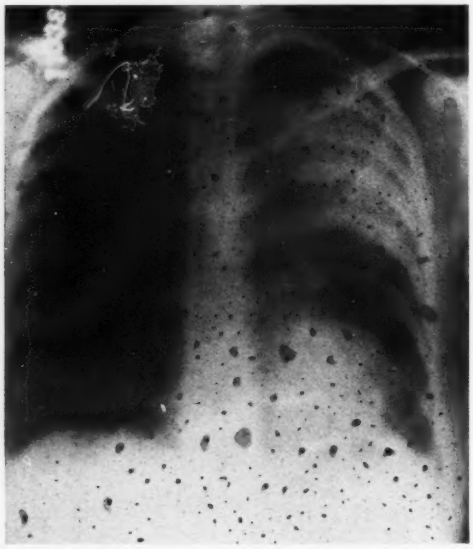


Fig. 18. Case VIII. (Damaged film.)

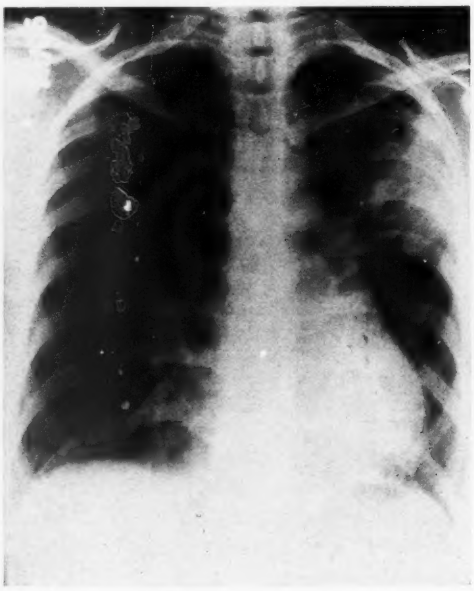


Fig. 19. Case VIII.

creased density in the lower medial portion of the right lung field. Extending off from this area of increased density are numerous fine radiating lines of similar density. A diagnosis of impending lung abscess was made. Bronchoscopy was done and an inflammatory obstruction in the right lower lobe bronchus was relieved. Cultures from the secretion revealed a streptococcus. X-ray studies (Fig. 22) now reveal an area of decreased density within the area of uniform density.

This case serves to illustrate the fact that actual destruction of lung tissue may take place without the appearance of a fluid level within the area of destruction. When drainage is established, evidence of such destruction may be had. We would repeat the importance of making, in cases in which it is possible, a diagnosis of impending lung abscess.

Case X.—This patient is a white male 42 years of age who underwent an appendectomy under spinal anesthesia thirty-six hours previous to the X-ray study shown in Figure 23. Within eight hours after the operation he showed an increase in his pulse rate and within ten hours there was an increase in the temperature and respiratory rate. Physical findings revealed a cyanotic patient with evidence of consolidation throughout the right lung field. X-ray studies revealed the characteristic findings of a massive atelectasia of the lung. Bronchoscopy was done, with immediate relief. X-ray studies taken immediately showed the clearing up of the markedly increased density in the right half of the chest, with a shifting of the heart toward its normal position.

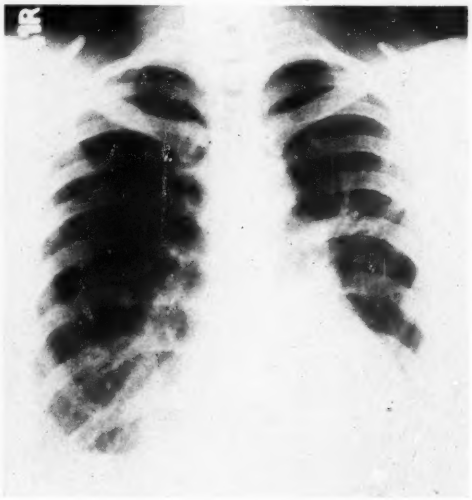


Fig. 20. Case VIII.

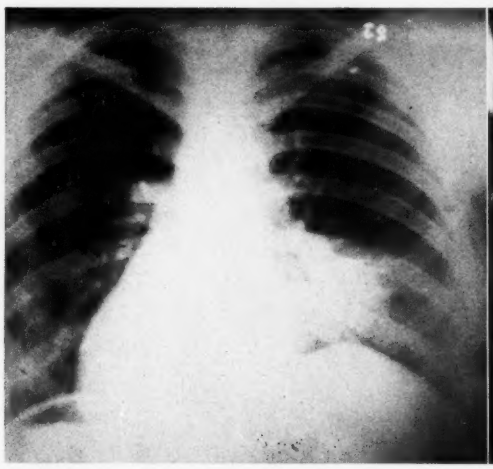


Fig. 21. Case IX.

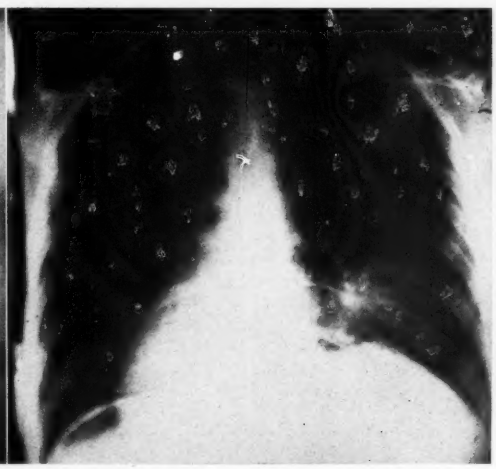


Fig. 22. Case IX.

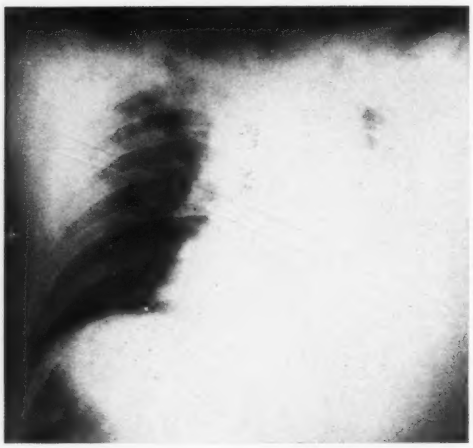


Fig. 23. Case X.

in the region of the left base near the midline, extending latterward to the chest wall with some displacement of the heart toward the right side. There is another shadow near the lateral chest wall behind the clavicle (Fig. 25). The diagnosis of lung abscess was considered in this case, but because of the displacement of the heart toward the right it was thought best to do a thoracentesis. This operation was done in the eighth interspace, about a finger's breadth lateral to the spine, resulting in the diagnosis of an encapsulated empyema. Thoracotomy gave further proof by the finding of such an encapsulation.

Case XII.—This patient was a white male

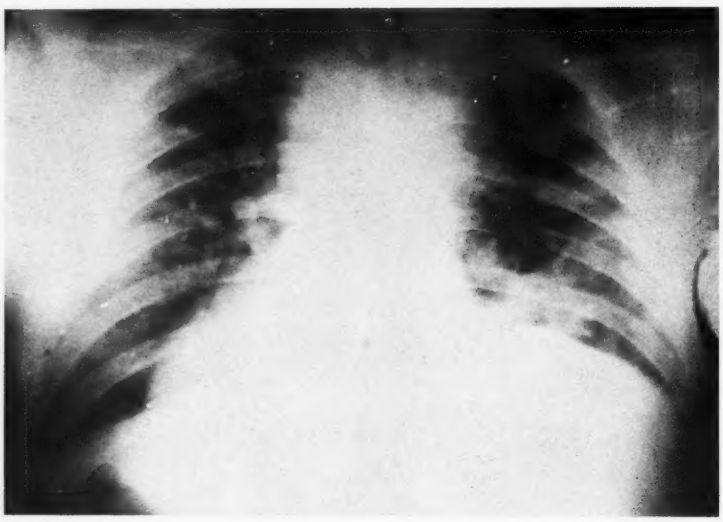


Fig. 24. Case X.

Case XI.—This patient was a colored male 35 years of age, who gave a history of an illness characteristic of lobar pneumonia. After an interval of improvement there was again an increase in the symptoms, especially temperature and cough, with a small amount of sputum (without odor). X-ray studies in the postero-anterior position reveal an area of increased density

8 years of age who gave a history of an illness similar to a pneumonia. However, his temperature at the end of four weeks remained around 103°, and there was clinical evidence of consolidation in the right chest. He had a cough, but no sputum. X-ray studies (Fig. 26) in this case show a fairly uniform shadow over the right lung field, with some narrowing of the right hemitho-

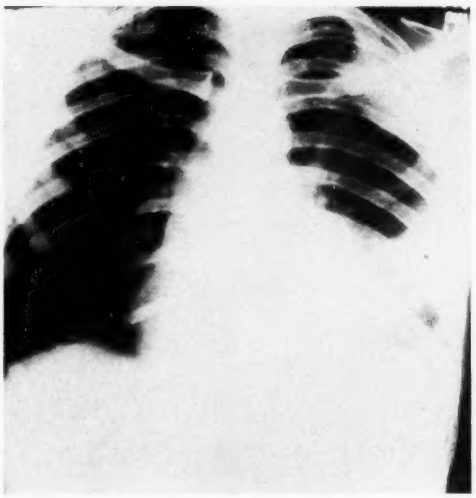


Fig. 25. Case XI.

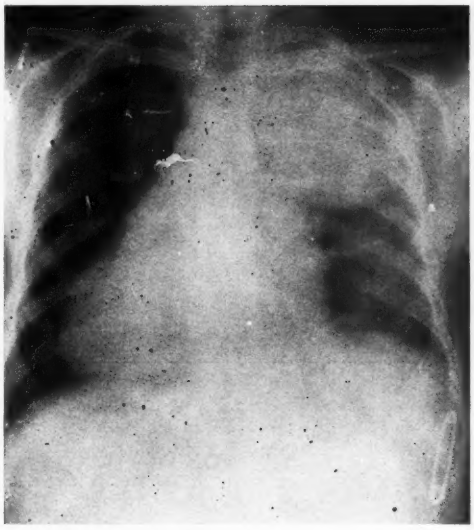


Fig. 27. Case XII.

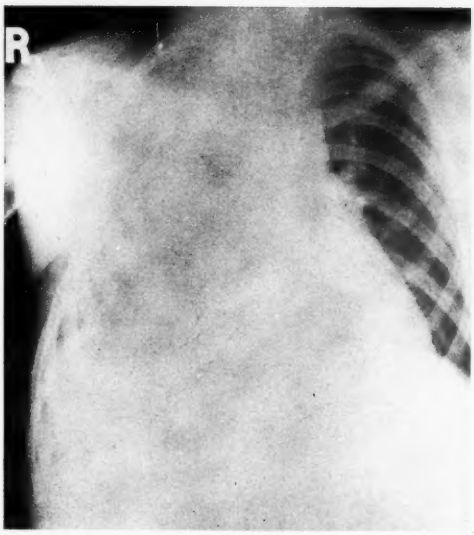


Fig. 26. Case XII.

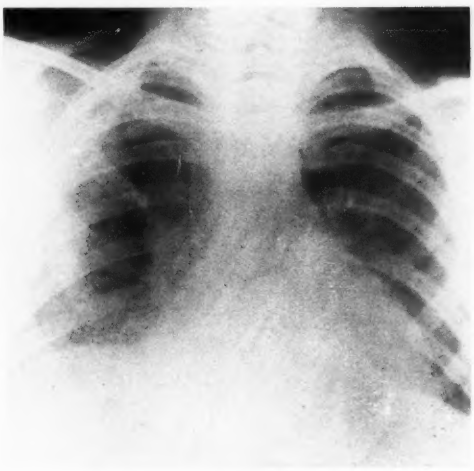


Fig. 28. Case XII.

rax. The density is greater near the midline at the base and extends to the lateral chest wall, particularly at the level of the clavicle. As to diagnosis, a massive atelectasis following pneumonia was considered, also that of an unresolved pneumonia. However, because of the peculiar distribution of the shadow, and the irregularity of the density in the lateral portion of the chest, a thoracentesis was done in the seventh interspace posteriorly about a finger's breadth lateral to the spine. Pus was obtained. Thoracotomy was performed, with satisfactory results. A follow-up film (Fig. 27) reveals the persistence of the shadow in the upper

lung field. A thoracentesis was done through the third interspace in the axillary line and this revealed a second encapsulated empyema, which was treated by thoracotomy. The third study (Fig. 28) on this patient shows

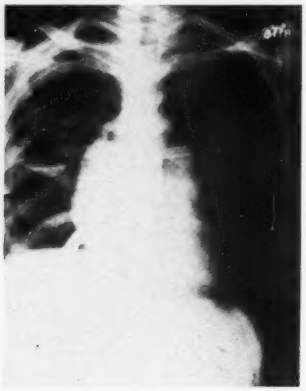


Fig. 29. Case XIII.

Fig. 30. Case XIV.

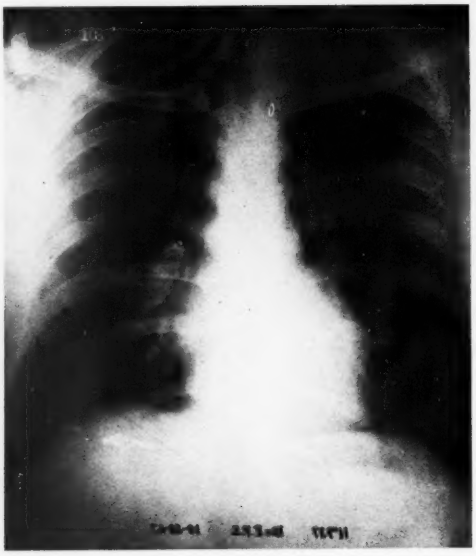


Fig. 31. Case XV.

Fig. 32. Case XV.

the entire disappearance of the area of increased density in the right lung field following drainage of the encapsulated empyemas.

These two cases will serve to illustrate the importance of considering encapsulated empyemas in association with studies of suspected lung abscess.

Case XIII.—This patient was a white male about 18 years of age, who had a severe case of diabetes. He entered the hospital with a history of an illness similar to a pneumonia, but at the end of several weeks he was expectorating large quantities of purulent material and was running a temperature. Physical examination still re-

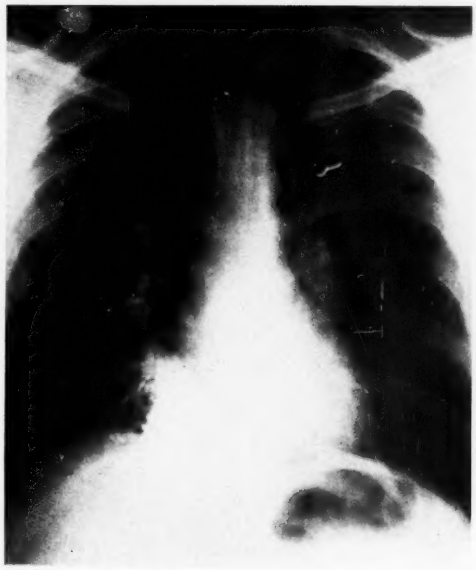


Fig. 33. Case XV.

Fig. 34. Case XVI.

vealed a dull to flat percussion note over the right chest posteriorly. Following a first X-ray examination a thoracentesis was performed and pus obtained from the pleural space posteriorly. Thoracotomy was then performed and a second X-ray study was made (Fig. 29). Note the thoracotomy tube in place. The findings that are of greatest interest, however, are as follows:

(1) An area of increased density along the right border of the mediastinum near the upper portion of which, near the level of the second rib anteriorly, one sees an area of decreased density with a horizontal line for its lower boundary.

(2) There is a second area of increased density near the level of the third rib anteriorly in the mid-clavicular line, right. The upper border of this area of increased density is also a horizontal line above which there is an irregular circular area without lung markings.

One is forced to consider the possibility of either or both of these areas representing a lung abscess. However, a thoracentesis performed near the right border of the sternum revealed pus. A thoracotomy was then performed and it was found that the medial shadows were due to an encapsulated empyema between the right lung and the mediastinum. This had been draining by way of the interlobar fissure to the area represented by the second shadow, thence through a bronchial fistula. The single thoracotomy drained both areas. The patient made a complete recovery. The final diagnosis in this case was empyemas, encapsulated, there being three separate pockets.

Case XIV.—This patient was a white male about 40 years of age who complained of a productive cough, some loss of weight, and of feeling tired. His complaints had gradually grown upon him. He did remember of having had a severe cold about four months previously. Physical examination revealed a temperature of 101°, and there was an area in the right lung field over which cavernous breath sounds were heard. X-ray study (Fig. 30) revealed an area behind the third rib anteriorly on the right, which was interpreted as a cavity. The

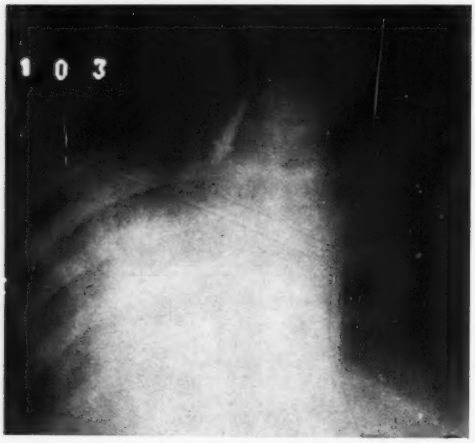


Fig. 35. Case XVI.

Fig. 36. Case XVI.

location was such that the roentgenologist could not say whether we were dealing with an old tuberculous infection, with cavity formation, or with a non-tuberculous cavity. Sputum examination revealed tubercle bacilli. The patient was treated for tuberculosis and progressed nicely.

Case XV.—This patient was a white male 28 years of age who had been troubled with a cough ever since he could remember. He

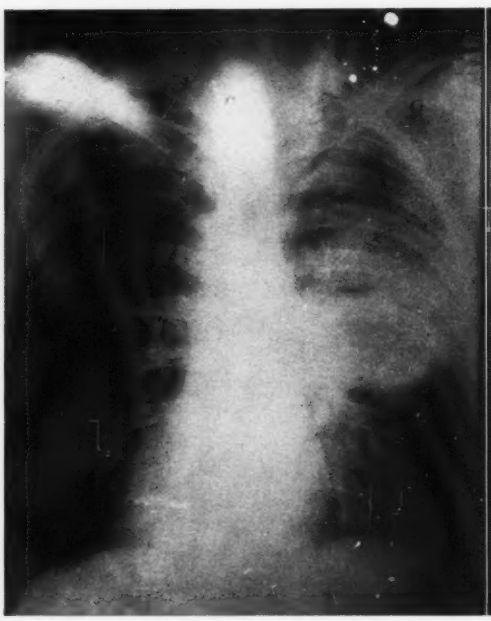


Fig. 37. Case XVII.

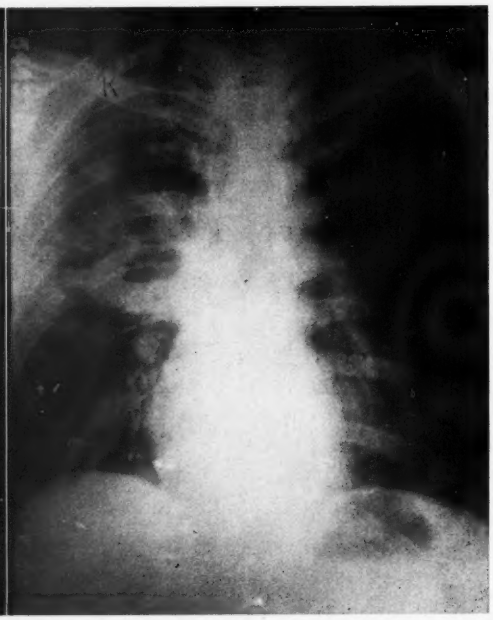


Fig. 38. Case XVII.

expectorated a very large amount of purulent material. There were no other symptoms and his physical examination was entirely normal except for an occasional râle at the base near the midline on the right side. X-ray studies had failed repeatedly to show anything that could be interpreted as being definitely abnormal. (See Figs. 31 and 32.) A bronchoscopy was then done and it was found that the orifice of the secondary bronchus from the lower lobe bronchus was inflamed and fixed. A tube was insinuated into the bronchus and it was aspirated, a considerable amount of purulent material being removed. Lipiodol (30 c.c.) was then allowed to flow into this area through the aspirating tube and the X-ray study was repeated (Fig. 33). This revealed an area of considerable extent adjacent to and confluent with the right heart shadow which undoubtedly represented a cavity. Diagnosis: Lung abscess.

This lesion was probably begun as a pleural process which ruptured through the lung to drain by way of the bronchial tree.

Case XVI.—This patient was a white male 12 years of age, who gave a history of having developed a cough at the age of 4 years. He was treated at that time for whooping cough, but the cough never disappeared in spite of many previous examinations and much treatment. At the time these studies were made, the patient was very ill, with a distressful cough, purulent sputum, and a temperature of 103°. There were physical signs of a consolidation over the entire right lower half of the chest. X-ray study (Fig. 34), using the regular technic for lung detail, revealed a shadow of markedly increased density over the right lower half of the chest. Inasmuch as this patient had been repeatedly examined in attempts to determine the source of his disturbance, it is felt that something more than a routine X-ray examination was necessary. Fluoroscopic studies were also made, paying particular attention to that portion of the lung involved in the area of markedly increased density. It was noted that there was one point of density which seemed to differ from the other points of increased density. Accordingly, other X-ray studies (Figs. 35 and 36) were made, using technic more suitable for bringing out bone detail. It is to be noted that there is revealed a shadow which resembles a wood screw, and that there is some irregularity in the outline of this shadow, which one might take to represent a deposit of rust or similar material about a screw. Lateral films reveal what might be threads on a screw. Bronchoscopic removal of a screw, coated with rust, resulted in the disappearance of the cough and a clearing up of the right base.

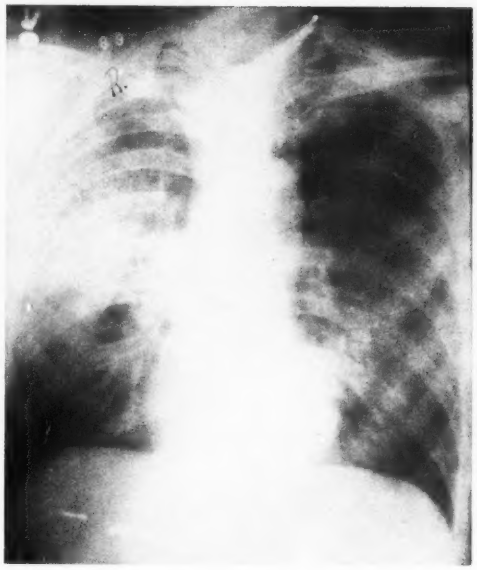


Fig. 39. Case XVII.

These studies are shown to emphasize the importance of fluoroscopy as well as multiple X-ray plate studies, and illustrate the ease with which even a metallic foreign body may be overlooked in the lungs.

Case XVII.—This patient was a white male 62 years of age who entered the hospital complaining of an illness which had

had an indefinite onset—malaise with a non-productive cough and a temperature. X-ray studies at that time (Fig. 37) revealed a large area of uniformly increased density occupying the middle portion of the right lung field. At one point there is noted an area of decreased density, the lower border of which is a horizontal line. Diagnosis of lung abscess or pulmonary tuberculosis with cavitation was made because of these findings. However, repeated sputum examinations were negative for tubercle bacilli. A bronchoscopy was done and pus was found to be draining from the middle lobe bronchus. An aspirating tube was inserted into this bronchus and the bronchus was thoroughly aspirated. X-ray studies were again made (Fig. 38) and it is to be noted that the area of markedly increased density has cleared to a considerable extent. However, the area of decreased density appears very much larger in these studies and there still remains a horizontal line. After thirty days, during which interval several bronchoscopic aspirations were carried out, along with postural drainage, it is to be noted that evidence of the infection has largely disappeared. The patient has remained well since. Diagnosis is lung abscess of unknown etiology.

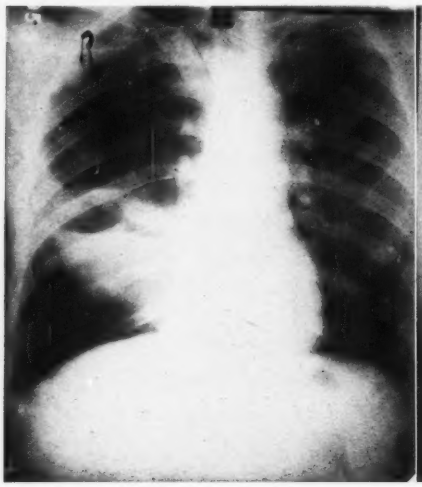


Fig. 40. Case XVIII.

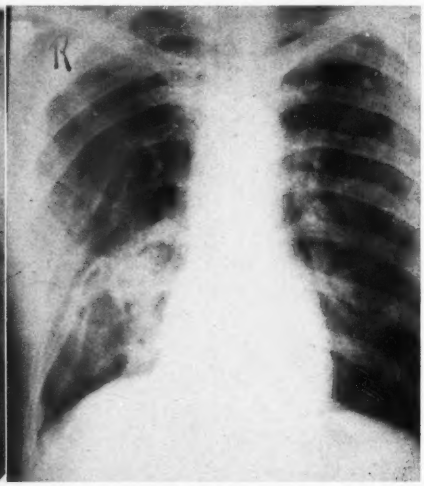


Fig. 41. Case XVIII.

Case XVIII.—This patient was a white male about 38 years of age who gave a history of having had a tonsillectomy performed under ether anesthesia five months previously. Two weeks following his tonsillectomy there developed a non-productive cough, marked malaise, and a temperature. During the succeeding five months he had a number of hemorrhages, coughed up large amounts of foul sputum, and lost a great deal of weight. Diagnosis of lung abscess had previously been made. He had been treated by bed rest, postural drainage, and pneumothorax. In spite of these measures the patient's condition became worse and at the time these X-ray studies (Fig. 40) were made the man was extremely ill. The studies show first evidence of the previous pneumothorax at the right base. There is also an area of increased density occupying

the region of the right lower and middle lobes. Associated with this is a large area of decreased density, the lower border of which is a horizontal line. Diagnosis of lung abscess was confirmed in the absence of tubercle bacilli in the sputum. The patient was operated on and open drainage of an enormous abscess, occupying the greater portion of the lower lobe of the right lung, was obtained. Recovery was without complications, leaving a bronchial fistula. X-ray studies at the end of one year (Fig. 41) show the deformity in the bony structure as well as the amount of scar tissue that remains. Lipiodol injected through the bronchial fistula, as a means of contrasting the bronchial tree, demonstrates the amount or the portion of the right lower lobe that remains (Fig. 42).

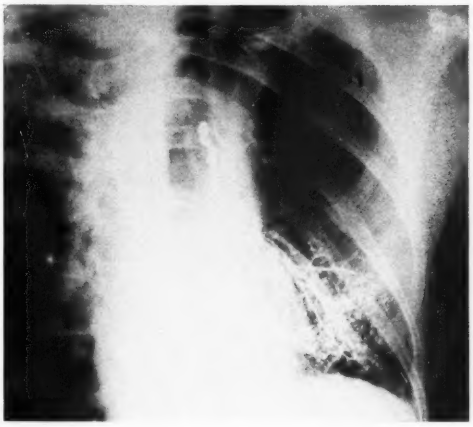


Fig. 42. Case XVIII.

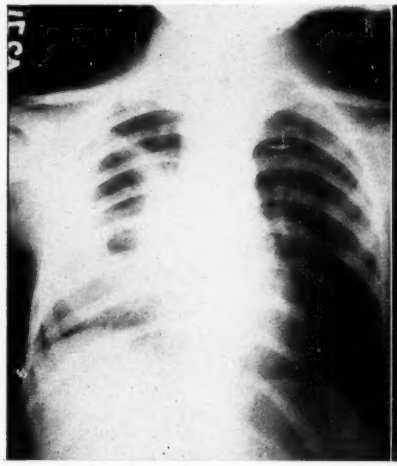


Fig. 43. Case XIX.

Fig. 44. Case XIX.

This case illustrates the importance of making an early diagnosis when possible. It also illustrates the degree of destruction and deformity that may be encountered.

Case XIX.—This patient was a white female 8 years of age who gave a history of having had a tonsillectomy done under ether anesthesia three weeks previously. Within the first week following the tonsillectomy there developed a non-productive cough, a temperature, and general malaise. After ten days the cough became productive, temperature remained high, and the patient's condition continued to fail. X-ray studies (Figs. 43 and 44) at the time she was seen, revealed an area of increased density occupying a considerable portion of the right

lung field. Within this area of increased density there was an area of decreased density which might be interpreted as a cavity.

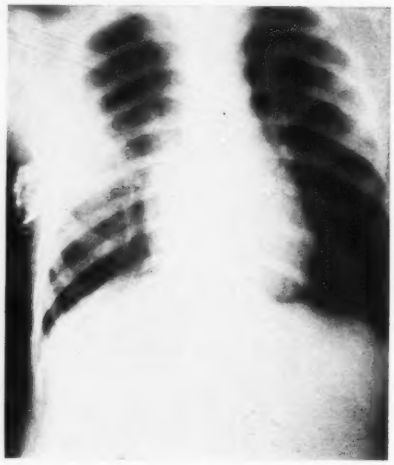


Fig. 45. Case XIX.

The lateral view (Fig. 44) shows the depth of this area in the antero-posterior position. Tubercle bacilli were not found in the sputum. Accordingly, diagnosis of lung abscess, post-tonsillotomic, was made. Because of its extent it was felt advisable to do an open drainage. This was accomplished by resection of ribs in the mid-axillary line, with drainage of the cavity at this point. X-ray studies at the end of six weeks show the extent to which the lesion has cleared.

This case, contrasted with the cases in which early diagnoses have been made, serves to emphasize the importance of an early diagnosis. The patient made a complete recovery.

We wish to thank all those radiologists who have been so liberal of their time and efforts when handling cases with us. We wish especially to thank Dr. Rollin H. Stevens, Dr. Hans A. Jarre, and Dr. Clyde Hasley for their unlimited patience with us.

THE ROENTGEN RAY IN DIAGNOSIS AND PROGNOSIS OF UPPER URINARY TRACT INFECTION

By H. W. PLAGGEMEYER, M.D., and C. G. WELTMAN, M.D., DETROIT, MICHIGAN

SINCE Nitze's epoch-making discovery of the cystoscope in 1877, no other single factor has added so much to the advance of urology or contributed so much to its scientific exactness as has the roentgen ray. Nor, by the same token, is any other branch of medicine so dependent upon the X-ray as is present-day urology. Indeed, without it, the urologist is entirely bereft of that which makes his diagnosis so positive and so nearly correct, urography and pyeloscopy having been aptly described as the urologist's most valuable aid in diagnosis.

It is an interesting chapter in the history of medicine which records the endeavors of such men as Tuffier (1897), Fenwick (1905), von Lichtenberg (1906), Keyes (1909), Uhle and Pfahler (1910), and others, in their efforts to render the upper urinary tract opaque to the roentgen ray. Many methods were used and discarded because of certain untoward effects, until, at the present time, probably the most widely used method is that of injecting sodium iodide of from 12 to 30 per cent solution until the kidney pelvis is filled, as evidenced by pain or discomfort to the patient, and then making a pyelogram in both recumbent and upright postures; and, finally, partly withdrawing the ureteral catheter and filling the ureter, thus making another exposure which outlines both the pelvis and ureter. Some urologists use a large catheter to obstruct the lower ureter and inject the pyelographic medium until the entire tract is distended by backflow. That there is still a great difference of opinion as to what constitutes the proper procedure in performing urography is stressed by Hinman in his work on hydronephrosis when he says, "Authorities differ as to the relative value of the different methods used in making ureteropyelograms."

In spite of the fact that X-ray has been used all these years to aid in making urologic diagnoses, the fact remains that, as it is generally used to-day by the majority of men, the X-ray does not give all the information which should be had from such a procedure or all that is essential to a complete understanding of the pathology of the upper urinary tract. Pyelography, while absolutely essential, as routinely done shows only the anatomical form or morphology of the urinary tract. Furthermore it is often necessary to repeat the examination because of some obscurity or baffling appearance. If the case is one of advanced pathology, then knowledge of gross anatomic change is probably all that is needed. But, in the great majority of cases, it is absolutely essential that a definite knowledge be had of the physiology or motor function as well as of the anatomic form in order properly to prognosticate and treat the case. Thus, to enable one to apply the correct therapy, a complete X-ray diagnosis must include a study of the physiology or motor activity of the pelvis as well as its morphology. Must one wait until there is gross tissue change before one can apply the proper treatment? What is therapeutics? According to Billings, "Therapeutics is largely an effort to convert pathologic into normal physiology. Intelligent therapeutics and pathologic physiology should go hand in hand." Thus, a knowledge of the form as well as the physiology of the pelvis and ureter can be obtained only by combining a motor functional study with pyelography.

The physiology of the pelvis and ureter is

analogous to that of the stomach and duodenum. They are both contractile organs endowed with a motor activity and a sphincteric function. The physiology of the pelvis is characterized by a succession of movements or contractions and relaxations, opening and closing of sphincters in a harmonious way and at a precise time. In nephrectomized kidneys preserved in saline, it has been observed that the kidneys contracted at times spontaneously but could be excited to contractions by mechanical stimulation either of the ureteral stump, pelvis, or calices. These excitations produced the following movements: the pelvis is first in diastole, or relaxed, extending beyond the renal sinus. By stimulating the stump of the ureter, the pelvis is caused to contract and withdraw itself up into the renal sinus, where it disappears, drawing the ureter after it. Presently one sees the pelvis slowly relax, little by little, and at the same time, a wave is produced in its inferior extremity and is propagated to the stump of the ureter, which executes a creeping movement. Then follows a sharp phase of inexcitability which continues for a variable period of time after each contraction.

Clinically, this phenomenon is beautifully demonstrated in the normal pelvis by injecting a pyelographic medium under fluoroscopic vision and, while the pelvis is filled (but not to the point of distention and production of pain), withdrawing the catheter and observing its contractions. One notes the following: besides the large respiratory movements, on close observation there is to be seen a wave of contraction progressing from calices to pelvis which carries with it part of the opaque liquid in the calices and causes them to appear more dense. This wave of contraction then spreads over the pelvis and forces some of the fluid into the bulb, that small portion between the pelvis above and ureter below, which has been closed until this time by the supra-bulbar sphincter. None flows into the ureter since at this moment it is closed by the infra-bulbar sphincter. At the time of filling the bulb, the systole of the pelvis, coinciding with the diastole or relaxation of the calices, produces a refilling of the calices. Also at the end of this period a second wave, or the first one momentarily arrested, beginning in the bulb, forces open the infra-bulbar sphincter and continues rapidly down the ureter to the bladder. The bulb remains visible generally for from two to three seconds. The supra-bulbar sphincter prevents reflux into the pelvis as well as emptying of the pelvic contents into the ureter. This process continues until the pelvis is empty. Masses in the amount of 1/10 c.c. are forced periodically from the bulb into the ureter. These masses appear from 3 to 10 seconds apart and pass rapidly down the ureter, outlining its curves and contractures. The pelvis normally empties its 5 to 10 cm. of injected material at the rate of approximately 1 c.c. per minute.

In studying the physiology of the pathologic pelvis, one notes abnormal fillings. Reflux around the catheter back into the ureter is abnormal if the tip of the catheter is well within the pelvis. This condition is often due to errors of technic, such as too rapid injection, or to the injection of too much liquid, resulting in acute pelvic spasm and production of severe pain in the patient. These errors immediately render further functional studies useless since they induce an abnormal physiology. This reflux is also seen where the sphincters are insufficient. In these cases, the opaque fluid runs down the ureter as the injection is in progress.

We next study abnormal modifications in evacuation, paying especial attention to the bulb, particularly noting its situation. It normally connects the inferior medial border of the pelvis with the ureter. It may be irregular and contorted due to peripelvic sclerosis, or one might see a notch or constriction running through it, caused by an

abnormal artery. This defect persists throughout the examination, but none of these deformities in themselves constitutes a disturbed motor function. Thus, in order to make a correct diagnosis, one must observe the entire picture and not an isolated finding, based on a single pyelographic plate. The bulb, as previously remarked, is formed normally every 3 to 8 seconds. If the evacuation be retarded, this rhythm is interfered with and the time between "bulbs" is prolonged. Yet, however retarded this rhythm may be, as a general rule the bulb empties itself promptly. Again, one at times sees a complete or incomplete loss of sphincteric power, in which case the liquid either flows or dribbles into the ureter more or less continuously. Here, however, one finds the evacuation retarded because of pelvic inactivity.

In considering abnormal *modification of contractions* of the pelvis, the degree of their intensity is of most importance. They may be either very active or completely abolished in a pelvis the walls of which are rigid and sclerosed. In discussing abnormal passage of the liquid through the ureter, Legueu says that in some cases stricture, kinks, calculi, etc., cause a mechanical stagnation and dilatation above the obstruction, but in most of these cases it will be impossible to pass a catheter by the obstruction. If the catheter passes and one succeeds in filling the pelvis, one sees after its withdrawal either a normal evacuation or pelvic retardation. If there is pelvic retention, it is not mechanical but reflex and one sees neither pelvic contractions nor bulb formations. Moreover, there is no accumulation of liquid between the kink or apparent obstruction and the pelvis. Finally one judges the time of pelvic evacuation by a study of the mode of formation of the bulb as well as the motility of pelvis and calices. The normal evacuation presupposes a harmonious equilibrium between two elements; the force which propels, *i.e.*, the contractions of the pelvic musculature, and the force which holds in check or rules over the intermittent discharge, *i.e.*, the pyelo-ureteral sphincters. The pathologic modification of the play of these two forces which brings about different degrees of impaired motility in the upper urinary tract. These variant degrees of disturbed motor activity may be classified as incontinences and retentions.

1. Complete pelvic incontinence is rare and is seen only in cases in which the pelvis and ureters are sclerosed, as in advanced tumor formation, in some cases of primary infection, and in some congenital dilatations. The fluid runs out into the bladder immediately after the catheter is withdrawn. One sees neither pelvic contractions nor bulb formation. In this type of case, one could get good pyelograms by filling the bladder with fluid and producing backflow into ureter and pelvis.

2. Where there are insufficient sphincters, the fluid immediately on injection flows into the ureter almost continuously. No definite formation of bulbs is seen and the flow of liquid is only temporarily interrupted from time to time. The evacuation is, however, prolonged since the pelvic contractions are very feeble. This type is similar to chronic incomplete retention and is seen in a large number of pyelonephritic cases.

3. In a very rapid evacuation or hyperkinetic pelvis, contractions are very strong, the bulbs are rapidly formed, and the pelvis is emptied very quickly. These cases, which give a history of marked vagotonia with attacks of renal pain, are benefited by the use of belladonna. We have recently seen a case of this type respond to this treatment. This class is very closely allied to acute spasm.

4. Under the heading of chronic incomplete retention, one finds several degrees of retention: slight retardation of evacuation characterized by slow formation of bulbs

and prolonged evacuation time; retarded evacuation with insufficient sphincters as mentioned previously; incomplete retention with residue where the evacuation starts out normally, but bulb formations become further and further apart and finally cease altogether, leaving a residue in the pelvis or calix; Crabtree's intermittent retention seen in movable kidneys, where one finds stasis during renal ptosis but, on relieving the ptosis, contractions are established. This latter test is the only true indication for nephropexy.

5. In chronic complete retention, the liquid remains in the pelvis for many hours and is finally diluted by secreted urine.

6. Acute spasmodic retention, due to errors in technic when a small pelvis is forcibly over-distended, occurs repeatedly when pyelograms are made blindly, and the patient is caused much needless pain and suffering.

Study of the physiology of the pelvis and ureter has pointed out the fact that a dilated pelvis is the result of an impaired motor activity. It is not in itself a primary condition. If it is dilated to such an extent that a diagnosis of hydronephrosis can be made from a pyelogram, then it will certainly show a markedly impaired function. More than this, functional studies by fluoroscopy will show an impaired motor activity or retention long before dilatation can be determined. Dilatation or anatomical change is slow to progress and only secondary to retention, which is influenced reflexly and changed readily. Dilatation and retention both represent an alteration of the pyeloureteral muscle but atony or dilatation is a stable state which changes slowly, while the motor activity represents the actual state of muscular contraction at a given time. It is true that the more marked the distention, the more deficient the motor activity. That the impaired function is primary is seen in types accompanied by small hydronephrosis with little or no distention, but having attacks of renal colic and a hyperkinetic pelvis, or in cases with incomplete retention. Here the deficient muscular activity produces retention which later leads to atonicity or dilatation. It is an established fact that the motor activity of the renal pelvis is very quickly influenced by reflex. This has been proved many times in cases of renal calculi, abnormal arteries, etc., in which the stasis rapidly clears up after removal of stone or section of an artery. From a prognostic view, let us point out the fact that a pelvis not dilated but having incomplete retention progresses slowly to dilatation and atonicity unless the cause of the retention is removed. On the other hand, a dilated pelvis which evacuates itself sufficiently is one in which the dilatation will improve as time goes on. To be of prognostic value, a functional study must show not only whether there be retention but also to what degree retention has progressed. Thus X-ray studies, to be complete, must show us the physiology as well as the gross anatomy of the pelvis. Ureteral catheterization demonstrates the bacteriology. Infection and distention of the pelvis do not progress equally. In fact, infection may mitigate against distention by producing sclerosis of the pelvic walls; however, the degree of infection and retardation in evacuation of the pelvis go hand in hand.

It is admitted by all that stasis is the prime factor in the perpetuation of the great majority of kidney infections. It is the bugbear of urologists. The treatment of kidney infection is, therefore, largely the correction of those conditions which cause stasis. Pyeloscopy not only shows the degree of stagnation, which is of prognostic value, but points out the causative factor, be it stone, kink, excessive mobility of the kidney, stricture of the ureter or other cause. After this causative factor is removed, the motor function soon returns to normal and then the infection responds readily. Bear in mind that this deranged motor activity is

often reflex and the pyelographic plate will show a pelvis practically normal in size and contour, but the fluoroscope will point out the fact that it is not functioning properly. Pelvic lavage will never clear up a pyelonephritis unless the motor activity of the pelvis is normal. When normal physiology is established, even gross pathologic anatomy will in time return to an almost normal condition, if too much permanent damage to the kidney parenchyma has not been done.

From a therapeutic viewpoint, pathologic pelves may be placed in two classes:

1. *Primarily Aseptic.*—Motor functional impairment is primary yet trophic disturbance or dilatation progresses along with it. If infection is added to this weakened organ, pyonephrosis readily follows. In this type, which includes the great majority of chronic pyelonephritic cases, the cause of the retention must first be discovered and removed, following which the infection is readily overcome.

2. *Primarily Infected.*—Here the normal pelvis is infected and, instead of large dilatations, one sees sclerosis, which likewise brings about disturbed function. The two thus work in a vicious circle. If the retention is complete in this type of pelvis, one had best do a nephrotomy and put the pelvis at rest. If it is impaired to a relatively slight degree, lavage may bring about cure.

CONCLUSION

May we emphasize the fact that fluoroscopy is essential in making an X-ray study of the kidney, for by it we—

1. Fill the pelvis sufficiently but never over-fill, thereby causing the patient severe pain.

2. Clear up obscurities by noting them during the examination, when they can be studied, and not later when pyelograms are being viewed. Under vision the kidney may be palpated, thus its mobility, relation to stone, foreign bodies, tumor, etc., may be noted.

3. Take pyelograms or permanent records of observed stages of pelvic activity and do not work blindly as in the past.

4. Learn what pyelography alone can not show us, that is, determine the physiology of the pelvis at the time of examination and point out the causative factor if its motor activity is impaired. By so doing, we render the examination truly scientific and save our patient much pain and suffering and, indeed, even prevent the possible loss of the kidney itself. It is not a difficult feat to remove a destroyed pyonephrotic kidney but how much better it is to correct disturbed function in its incipiency and to prevent destruction of the kidney. This then must be the service the roentgen laboratory can render the urologist in the future.

FRACTURES AND INCOMPLETE DISLOCATIONS OF THE MANDIBLE OR MAXILLA

By LLOYD ROGERS, D.D.S., C. TAYLOR HALL, D.D.S., and JOHN H. SHACKELFORD, D.D.S., DETROIT, MICHIGAN

LET us say at the outset that it is not our intention to impose our methods upon others. Our only intention, indeed, is to attempt to give some practical instruction on the subject of fractures—a subject which has, in the last few years, been one of increasing importance to the dental, as well as to the medical, profession.

While our method of treating fractures is neither new nor complicated, the results obtained have been highly gratifying. And we believe we may be pardoned the assumption that if results are satisfactory, the methods employed must be worth some consideration.

FRACTURES

During the past sixteen years we have seen and treated a large number of fractured jaws. In 1928 our clinic extended services to 312 patients; in 1929 this number was increased to 376 patients, and in 1930 to 482. Of this number, 94 per cent were treated for fractures of the mandible, the remainder for fractures of the maxilla.

Detroit, curiously enough, seems to have earned a reputation for skull and jaw fractures. This phenomenon may be partly attributed to the fact that, being the motor center of the world, rapid transportation here is on a steady increase, bringing in its wake an inevitable and concomitant increase in accidents. As a matter of fact, Detroit has more automobile accidents, *per capita*, than any other city in America, and automobile accidents appear to be the chief contributing cause of fractures.

Next to vehicular accidents, John Barleycorn must come in for a substantial share of the blame. Intoxication leads frequently to fights, and fights to broken jaws. Add to these the occasional meetings of skull and black-jack, falls, gunshot wounds, and numerous other accidents which occur readily

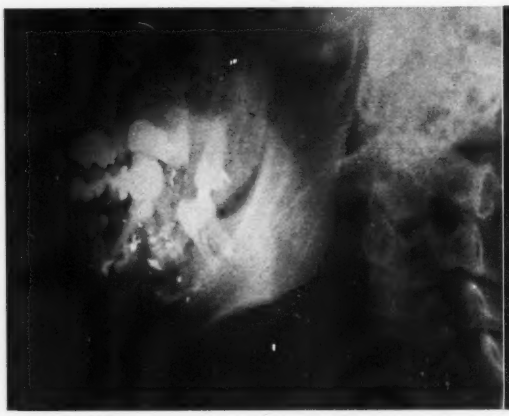


Fig. 1. Gunshot fracture of mandible and maxilla.

Fig. 2. Head of condyle destroyed by gunshot.

Fig. 3. Gun slug fracture of mandible, with large facial wound.

Fig. 4. Fracture of mandible, showing the usual condition from non-treatment or no immobilization.

in a large city, and it is easy to see how the number of fractures grows.

It has been our observation that many fractures of the jaws are overlooked. For example, a patient is taken to a hospital from the scene of an accident. He is probably unconscious. At the receiving room a diagnosis of probable skull fracture is made, and X-ray films are ordered. The X-ray department makes the radiographs of the skull but neglects to examine the jaws. Even when the jaws are examined, a fracture in the condyle region may be missed and too often we find a fracture of the maxilla undiagnosed, especially in the edentulous patient.

In our clinic at the Receiving Hospital, Detroit, all patients with head injuries are given an X-ray examination for jaw fractures, and in many cases we advise a postero-anterior plate to determine whether or not the patient has a fracture in the condyle region. For this purpose right- and left-angle jaw plates are always taken. If any doubt remains, the roentgenologist orders a digital examination in the oral surgery department, regardless of whether the patient is in the hospital or the Out-patient Department. We hold it inexcusable for the hospital to release a patient with an overlooked fracture of the jaw. All too frequently hospitals do release such patients. At the time of this writing, for instance, we are treating the wife of a prominent citizen of this city for a fractured jaw in the condyle region. Following an automobile accident, this patient had been hospitalized in a first class hospital for ten days, where she was treated for sprain and abrasions. Although X-ray films were taken of the skull, jaws, arms, and legs, the fracture of the mandible was not found. The woman complained of pain in the jaws, but jaws and skull remained negative in the diagnosis. We mention this in no derogatory manner, but offer it as constructive criticism. Too much care can not be exercised in our examination of these patients; jaw fractures should be detected before the patient is released from the hospital.

PRINCIPLES OF TREATMENT

The fundamental principles employed in the general treatment of fractures may be applied, with some modifications, to the re-

Fig. 5. Simple fracture of the rami of the mandible through the sigmoid notch. Treatment was conventenial immobilization.

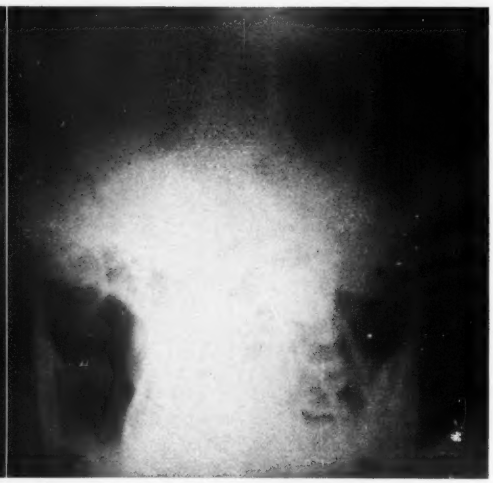


Fig. 6. Fracture of the rami of mandible through the sigmoid notch with displacement of condyle. These cases usually require a general anesthetic for relaxation and manipulation.

duction of fractures of the mandible and maxilla. These are:

1. Diagnosis from X-ray findings. General physical and oral examination.
2. Reduction of the fracture, or fractures, and possible manipulation for the fracture at the head of the condyle, or where there is an overlapping of the fragments.
3. Fixation of the parts: splints (silver wire open reduction), interdental wiring, Barton's, or plastic Barton casts.
4. Post-operative treatment.
5. The use of exercising splints, in some cases, to restore the function of mastication and to hasten the return of normal muscular tone. Likewise, in a few cases, orthodontic appliances to restore normal occlusion.

CONSIDERATIONS BEFORE REDUCTION

First, for the benefit of the doctor, and as a matter of record, the patient should always be subjected to X-ray examination before reduction is attempted. The oral cavity should be made as clean as possible, and all septic material, such as deposits of tartar and diseased roots, should be removed. All abrasions and wounds should have surgical treatment, according to the requirements of the individual case.

Many surgeons advise the removal of teeth and roots found in the line of fracture. In our experience, however, we have found that this procedure is not always advisable, and indeed, in many cases, actually contraindicated. We can show records of fractured mandibles in which such teeth have held the fractured portion of the mandible in the correct position, aiding us in obtaining the final anatomic relationship desired in the reduction of the fracture. Another factor to be considered is that sometimes the removal of these teeth is the cause of osteomyelitis, due to the frequent occurrence of considerable trauma in extraction. Many of the retained teeth are extracted later (possibly after a period of ten days). By this time they will have served their purpose, especially in fractures of the mandible at the angle, in which instance the posterior

fragment would tilt upward or forward were these teeth not retained.

In a case, however, in which there is a tooth that prevents the approximation of the broken fragments or otherwise interferes with bone alignment, we do not hesitate to advise extraction: such a tooth should be removed.

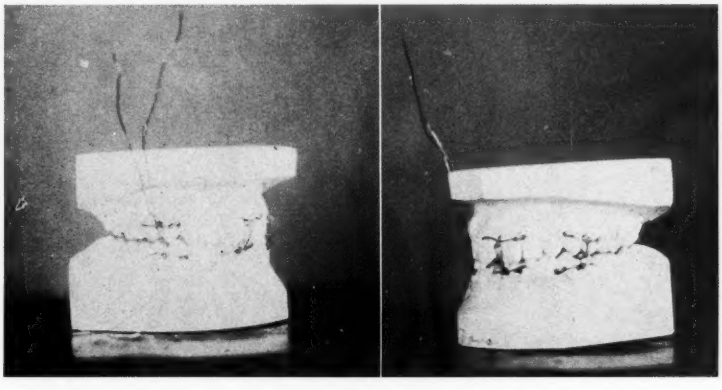


Fig. 7. Interdental wiring.

In gunshot fractures it should be remembered that when a bullet stops going it stops doing damage. The spectacular operation for the removal of such a foreign body is rarely, if ever, warranted. The patient should be allowed to recover from the shock, as often more damage is done in trying to remove the bullet than had it been forgotten. Should, however, any metallic pieces from a spattered bullet be in line of fracture, or if the bullet or fragments of bullet or bone can be visualized or removed without a great deal of destruction to the surrounding tissue, then they should be removed.

Jaw fractures associated with other complications, such as skull fracture, injuries to the chest, etc., require a few days of complete rest before an attempt is made to reduce the fracture. It would be unwise immediately to start immobilizing with interdental wiring because of the danger of shock and strangulation. Reduction can be accomplished just as effectively later, without taking chances.

Other important considerations in the treatment of fractures are sequestra, cysts, impacted teeth, and possible growths. Recently a patient presented himself, stating that he had a broken upper jaw. Upon examination, we saw the largest fibroma on record in the mouth—it measured seven inches in circumference and weighed 131 grams. It was attached to the roof of the mouth in the upper left molar region, and also across the roof of the mouth at the anterior border of the soft palate. It was highly vascular, but not malignant. The growth had caused considerable pressure atrophy, and the maxilla on the left side had become so weak that a very slight blow had been enough to cause the fracture.

REDUCING THE FRACTURE

Occlusion.—In reducing a fracture in an instance in which the teeth are present, careful attention must be paid to their occlusion. This feature is most important, for, if overlooked, even if there is union of

Fig. 8-*A*. Patient with fractured maxilla and large fibroma.

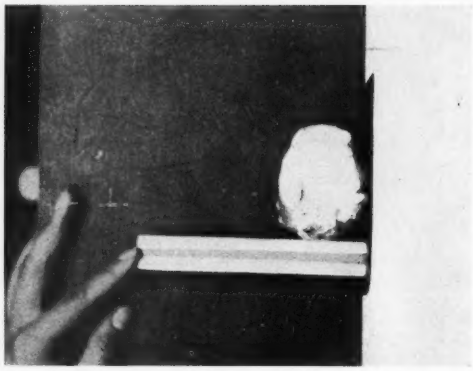


Fig. 8-*B*. Fibroma 7 inches in circumference removed from patient's mouth.

bone, the results will be unsatisfactory. If the teeth can be placed in normal occlusion or in the manner in which they occluded before the jaw was fractured, and can be retained in that position long enough for osseous union, the results will be satisfactory.

Anesthetics.—Often a fracture may be reduced without anesthesia, with practically no pain. In cases in which anesthesia is indicated, we prefer the use of conduction rather than general anesthetics. With the former we are able to secure the co-operation of the patient, and have very little, if any, vomiting or nausea with which to contend.

When a general anesthetic is employed, we usually place the interdental wiring loops on the teeth before administering the anesthetic. After the patient has been anesthetized, we do such surgery or manipulation as is indicated. When the patient has sufficiently recovered from the effects of the anesthetic, the teeth are placed in occlusion and the connecting wires passed through the loops and twisted into place.

Interdental Wiring.—Interdental wiring is the best method for immobilizing fractures of either the maxilla or mandible. The teeth are always placed in normal or original occlusion. If this is not accomplished at the first sitting, the teeth will usually pull into position when the wires are tightened the second or third day, and the muscles of mastication will always be at rest. When the teeth are placed in original or normal occlusion the fragments of the bone must be in correct anatomic position; when the teeth are present no fracture requires more accuracy in reduction than that of the mandible.

The advantages of interdental wiring are—

(1) Normal or original occlusion, correctness of median line, and harmony of facial expression are obtained.

(2) Only a few instruments and 28-gauge wire are required.

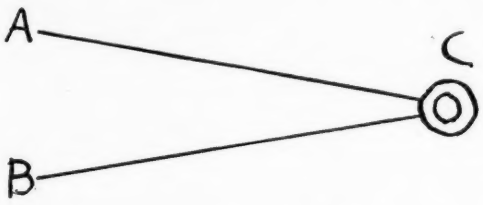
(3) Interdental wiring requires less time than the making of splints.

(4) Interdental wiring is not annoying to the patient.

(5) Interdental wiring is the most accurate and dependable of all methods.

Method of Interdental Wiring.—Our favorite method for reducing fractures of the mandible is to support the mandible (teeth in occlusion) to the maxilla from three points: the bicuspids, or first molar region, on each side of the mouth, and the centrals in the anterior portion.

A piece of wire, 26- or 28-gauge, 10 inches long, is doubled and twisted around a small round instrument (a wooden applicator is a good size) about two or three turns, producing a small loop or eyelet at the end of the wire where it is doubled.



The wire is now taken and the two ends ("A" and "B") are inserted at the buccal surface, passed from the buccal to the lingual surface, and then pulled through between the second bicuspid and the first molar, leaving the eyelet ("C") protruding a little just buccalward of the soft tissue between the two teeth. The wire ("A") is then pushed from the lingual to the buccal surface between the first and second molars, is pulled tight, and passed through the eyelet ("C"). The wire ("B") is passed from the lingual to the buccal surface between the first and second bicuspids and pulled tight. With a small blunt instrument, the wires are pushed well up on the necks of the teeth and the two wires ("A" and "B") are twisted to the right and pulled outward at the same time until they are firm and secure. Our rule of twisting all wires to the right has proved helpful to us at our clinic. In cases in which some slight adjustment is necessary, whoever is on duty, whether he has seen the patient before or not, knows that wires always are turned to the right. We have found this rule very helpful.

The other wires are placed below in the same manner and on the opposite side and the anteriors passed between and around the centrals. We are then ready to occlude the mandible with the maxilla. Usually two wires are passed through the loop on the upper and then through the loop on the lower teeth (Figs. 7-*A* and 7-*B*). The teeth are brought into correct relationship, and the wires are twisted tight by a turn to the right and a gentle pull outward. The wires

Fig. 9. Fracture of the mandible with posterior fragment tilted forward and upward.

Fig. 10. Fracture of both mandibles at the mental foramen, with marked overlapping of fragments.

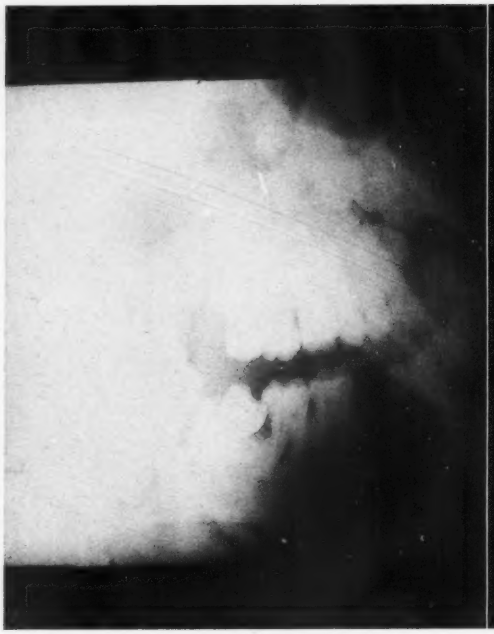


Fig. 11. Fractured mandible; third molar in line of fracture.

Fig. 12. Fracture of mandible in region of angle showing muscle pull.

are then cut short and turned in so as not to interfere with cheeks or lips. All wires must be kept tight so that they will not slip.

In wiring the mandible to the maxilla in this manner it is a very simple matter to cut the three wires, if for any reason the mouth has to be opened. Only a few minutes are required to pass new wires through the same eyelets and retie the teeth in occlusion. Lacing the two teeth together as described, with "A" and "B" wires, to hold the eyelet in place, offers less opportunity for loosening of the teeth than if single teeth were used.

When the fracture of the mandible is in the condyle or sigmoid notch region, frequently the muscles will pull this fragment outward, sometimes forward, perhaps inward, even after the interdental wiring has placed the teeth in occlusion. If the distal fragment has moved outward, we advise an extra-oral splint or a plastic Barton bandage, with a gauze sponge or other soft pad under the splint or Barton bandage at the location of fracture to act as a depressor until union has begun.

In fractures of the maxilla we employ the same method of interdental wiring, while with plastic Barton bandages we mold a plaster cast which holds the mandible against the maxilla. We have applied this method with good results in cases in which the maxilla has been fractured through both orbits and the nasal sections, allowing it to drop downward.

In cases of multiple fractures of the maxilla or mandible, we often use the small size bar, such as is used for a lingual bar in prosthodontia, or medium piano or platinum wire, shaping this to fit the arch of the mouth just labial to and buccalward of the necks of the teeth. It is then laced with 28-gauge wire to the necks of the teeth by passing the wire around the necks of the

different teeth at the gingiva, and twisting the wire tight around the bar. The bar may be attached to several teeth to hold the fragments and the teeth in correct position in the arch. Sometimes, if necessary, bars are used on both sides of the teeth, and are attached to the teeth in the maxilla and the mandible. After these bars have been attached so that the arches correspond and the teeth can be placed in occlusion, the mandible is attached to the maxilla, the 28-gauge wire being passed over and around the bars on the buccal and lingual surfaces, the wires being twisted tight, as previously described in interdental wiring.

Post-operative Care.—The average fracture requires four weeks in which to unite. We have had excellent results in three weeks, while other cases have required as many as nine weeks.

Although we have tried all kinds of special diets and light therapy to make bone unite more rapidly, none has proved very satisfactory.

We insist on a mouth wash every three hours. We see the patient usually every two or three days; if necessary, every day.

We employ aniline dyes, crystal violet and brilliant green, for post-operative treatment, followed by a saline mouth wash. For this purpose sodium perborate (saturated solution) is prescribed.

FRACTURES OF THE MANDIBLE EDENTULOUS

Some operators prefer taking impressions and making vulcanite base plates for splints, adding the vulcanite bite rims, wiring the splints together by drilling holes through the rims and fastening them together with wires. In the central region the vulcanite bite rims can be omitted for the passage of nourishment, and the Barton plaster cast used over the head to immobilize the mandible with the maxilla. If the patient has dentures, holes may be drilled in the dentures, and then wired together. These make excellent splints.

Circumferential Wiring.—In this case only the base plate can be used. Silver wires

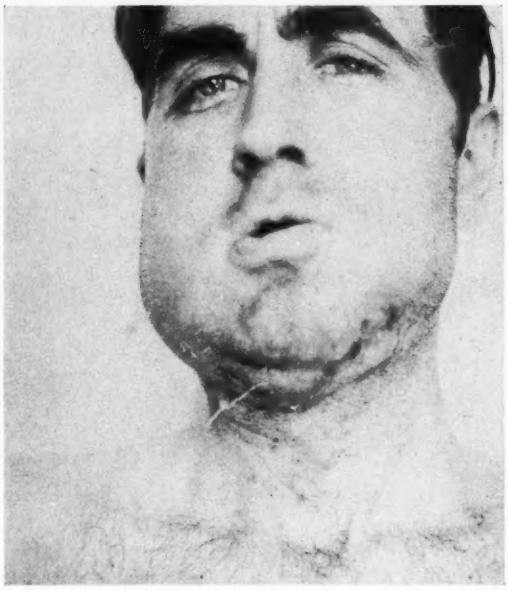


Fig. 13. Multiple fractures with severe facial lacerations.

are passed through the soft tissues, one on each side of the fracture, under and around the mandible (intra-oral), and twisted tight over the base plate, holding the fragments in alignment with the base plate.

Open Reduction (Intra-oral) for Fractures of the Mandible (Edentulous Cases).—We have used the following method extensively and have found it satisfactory, therefore, we prefer it to other methods. In cases in which teeth are not present, an incision is made on the superior border of the mandible, extending two or three inches distally and mesially of the fracture. With a periosteal elevator the tissue is flapped back, exposing the bone at the point of fracture. The two ends are raised up and a surgical

Fig. 14. Multiple fracture of maxilla and mandible.

burr or drill is used to drill two holes in each fragment, one at the superior border and one at the inferior border of each. Two silver wires, 20- or 22-gauge, are used, one of which is passed through the superior hole of the mesial fragment and then through the inferior hole of the distal fragment. The other wire is passed through the superior hole of the distal fragment and then through the inferior hole in the mesial fragment. The ends of the bone are brought into anatomic relationship and the wires are twisted just tight enough to hold the fragments together. Now the surplus wire is cut, the ends are smoothed, and pressed against the bone. The flaps are put back in place and sutured. The usual post-operative treatment then follows.

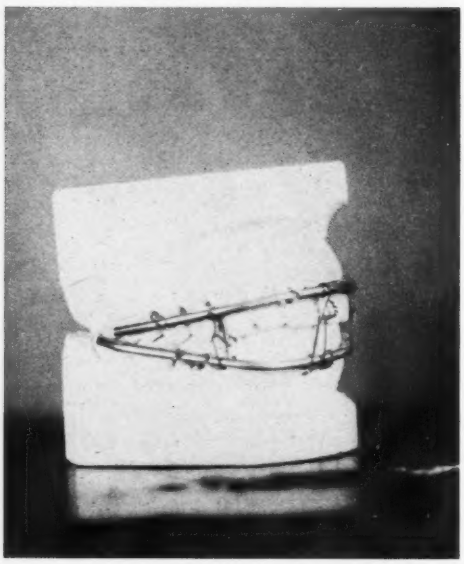


Fig. 15. Wiring method for multiple fractures of mandible or maxilla.

Fig. 16. Intra-oral open reduction, 20-gauge silver wire.

We have had patients 60 and 65 years of age, all of whom have made excellent recoveries from fractures of the mandible that have been treated in this manner. While we are aware that some surgeons prefer to use this method extra-orally, we believe that it is seldom, if ever, indicated.

In treating children for fractured jaws, the interdental wiring should be used when-

Fig. 17. Barton plaster cast.

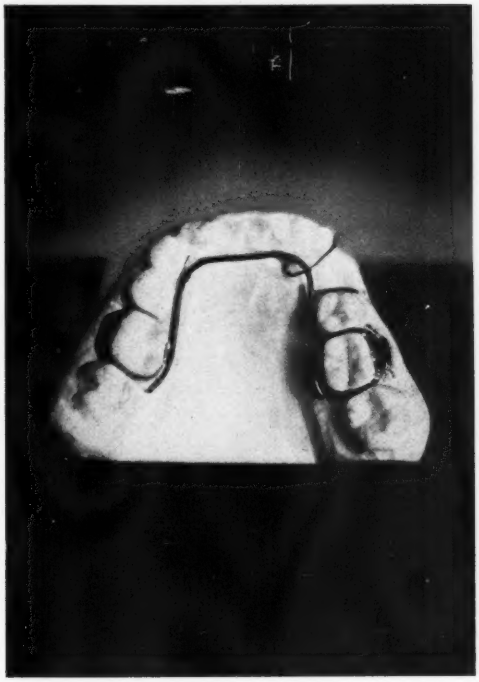


Fig. 18. Orthodontic splint used to correct and retain occlusion.

ever possible, but seldom can wires be attached to the deciduous teeth. In many cases, the child will not be old enough to have teeth which can be used for interdental wiring. In these cases the fracture is reduced and held in position with Barton's bandage. A thin Barton may be used for a pad, over which adhesive 1 or 1½ inches in width is applied. First the Barton and then the tape is passed under the chin and over the head, and then around the base of the head and forehead to keep the Barton from slipping forward or backward.

Fractures of the mandible that have not had professional treatment for several days, weeks, or even months are not uncommon. In some cases a Barton bandage may have been placed under the chin and over the head in such a manner as to cause an overlapping of the fragments. A fibrous union has possibly started, with fragments out of alignment. The best results in these cases are obtained by removing the fibrous tissue and exposing the ends of the fragments, which are then freshened with a large burr or file. The flaps are returned and sutured into place, followed by the usual procedure of immobilization.

We have seen several cases of fracture of the mandible in which the head of the condyle has been completely destroyed by gunshot. Treatment of these cases is usually governed by the amount of damage or destruction caused by the bullet or slugs. Infection may or may not be present. The wound may be almost closed, or large and open, depending upon the size of the bullet or slug and the distance from which it was fired.

When a small bullet, such as a 32- or 38-

Fig. 19. Fracture of mandible. Third molar holds distal fragment in position.

Fig. 20. Fracture of the mandible, showing considerable loss of bone, due to lack of immobilization.

caliber, has entered the condyle region, with destruction of the head of the condyle and with no infection present, if the location of the bullet is non-vital, we have found it advisable not to disturb or open this region. Nor do we immobilize these cases, as we wish to form a pseudo-articulation or a false joint. The patient is put on a liquid diet, followed by a soft diet, then, in two or three weeks, a normal diet. The continual movement thus provided during the healing process prevents ankylosis from taking place.

With gunshot fractures of the mandible, in which the head of the condyle has been destroyed, the laceration of the tissue has presented itself within a few hours, our procedure is to sterilize the field of operation, remove all fragments of bullet and bone possible without further destruction of tissue, and, with a burr, smooth the head of the condyle or that portion of the bone which is left. Some of the fascia is then drawn over the smoothed head, being held in place with soluble sutures. Drainage should be established if indicated, or the wound closed. There is immobilization, and the same diet is ordered as for small bullet wounds.

INCOMPLETE DISLOCATIONS

Dislocations of the lower jaw are usually intracapsular because of the wide articular capsule which permits displacement without division of its surface, *i.e.*, dislocation in the most simple form. Through relaxed conditions, one or both condyles may lodge upon the intra-articular cartilage over the eminentia articularis. Relaxation of the external lateral ligaments and the enlargement of the articular capsule, with absorption of the anterior bony wall of the external auditory meatus, may be caused by loss of teeth, improper articulation, irregularity of teeth, or deformities of the maxilla. These conditions cause abnormal movement of the mandible and result in the enlargement and absorption of the capsule and adjacent bony structure of the glenoid fossæ.

When the joint capsule is relaxed and the surrounding muscles and ligaments have lost their tone, the condyle is allowed free movement and incomplete dislocation results. In these lesions, small parts of the articular cartilage are impinged, pain in the side of the head and in the ear often resulting. The patient then consults the otologist for relief, but, upon examination, the

specialist finds nothing wrong with the ear or adjacent structures. This condition is very puzzling to the doctor who may not be familiar with it. In these cases, the patient's mouth should be examined for the loss of teeth, improper articulation, and false movements of the mandible.

Slight unilateral dislocations of the temporal mandibular articulation are quite frequent; in fact, they might be classified as common. However, due to the fact that the pain or discomfort resulting from this is usually mild (in only a few cases is the pain very acute) and that this condition usually subsides without treatment, little or nothing is found in the literature on the subject. Often when patients complain of this discomfort, other causes are looked for, and frequently such diagnoses as neuralgia, arthritis, and myositis are made. The chief complaint in these cases is a radiating pain throughout the temporal region, greatly aggravated during movements of the lower jaw.

The nerve supply to the temporal mandibular articulation is derived from the auriculotemporal and masseteric nerves, the latter constituting a branch of the mandibular division of the fifth nerve, which communicates with the facial nerve.

When the lower jaw is depressed to a great extent, the interarticular cartilage is drawn forward and the capsular ligament may be injured, or even ruptured. Causes of dislocation of this nature include yawning, convulsions, undue pressure with mouth gags, choking and vomiting, and the taking of too large bites.

Another class of partial dislocation is that in which the displacement is forward and lateral. The teeth may have been worn smooth and the patient may favor biting on one side; there may be unilateral absence of teeth, compelling the patient to use but one side of his mouth for mastication; dental restorations may be too high or too low, resulting in a slight backward dislocation. In these latter cases the interarticular cartilage is usually injured. The teeth will be found to have been worn down to allow the lower jaw more nearly to approach the upper when the jaws are closed. Also, plates are made which prevent the jaw from assuming its natural position at rest. In edentulous cases in which plates are not worn, another cause may be found in systemic conditions which result in loss of synovial fluid.

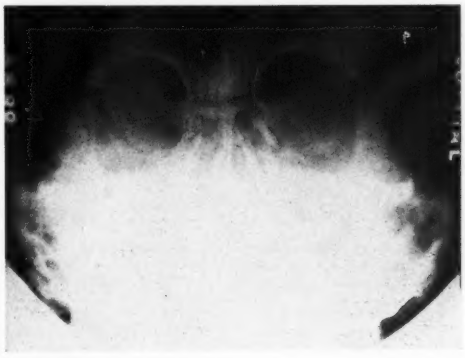


Fig. 21. Fracture of the maxilla through the nasal and both orbital regions.

It would seem that nearly everyone might be suffering from some discomfort in the temporal mandibular joints; however, this is not the case and usually dislocations do not occur unless the enumerated causes are quite exaggerated or the ligaments have been severely injured at some time, causing four of them to lose their tone. Patients complaining of this pain usually give a history of former injury. They also complain of having had slight neuralgic pain. In other words, the pain continues to be intermittent unless the cause is determined and corrected. At examination, the patient is required to open and close his mouth, disclosing the fact that the lower jaw drifts ever so slightly to the unaffected side.

Treatment consists in manipulation of the jaw to release any tissue within the joint and the carrying of the interarticular cartilage to its proper place between the condyle

and the glenoid cavity. If the lesion is slight, manipulation, and instructions to the patient not to open the mouth wide for two days are usually sufficient. However, in severe cases, the jaw should be manipulated, the teeth wired together by means of interdental ligation, and the jaw kept at rest for two weeks.

GROWTH-CONTROLLING EXTRACT BEING TRIED IN CANCER

A substance having remarkable powers of controlling the growth of living beings and of possible value in the treatment of cancer is being investigated in the laboratories of the Royal College of Surgeons of England and at King's College, London. The discovery is due to a young biochemist, J. H. Thompson, who has found that an extract of the parathyroid gland of cattle will restrict or prevent growth without endangering the health of the organism.

The most important application of this discovery lies in the treatment of cancer. It is being tested in several London hospitals with very encouraging results. Sir Arthur Keith has further suggested that it may be of value in the treatment of the disease called acromegaly or gigantism which is due to abnormal functioning of the pituitary gland.

The effect of the extract was first observed on rats and rabbits, then on watercress. At the suggestion of Prof. Julian S. Huxley it was tried on the axolotl, a form of salamander. In all these cases the growth-retarding effect has been very marked. Treated rabbits have remained at about half the size of their untreated brothers and sisters. The germination of watercress seeds is entirely stopped by a 20 per cent solution of the extract.—*Science Service.*

INTRAVENOUS UROGRAPHY[1]

By ROBERT E. CUMMING, M.D., DETROIT, MICHIGAN

UROGRAPHY is an all-important part of diagnostic effort in the study of genito-urinary tract disorders. Roentgenologic examinations of the entire urinary tract are routine in every clinic and hospital; more common investigation of the genital tract, in both male and female, would be of great value and may safely be predicted. Lately Sargent has made exhaustive studies of the seminal vesicles and the vasa deferentia, and Jarre with his Cinex camera has shown interesting possibilities in serial work upon the uterus and oviducts. We are familiar with Belfield's immensely valuable seminal vesicle roentgenograms in connection with his vas puncture therapy. One has only to secure a few seminal vesiculograms to note the wide structural variations in these pouches, which, coupled with careful visualization of the vasa and their ampullæ, constitute graphic evidence of disease possibilities and have a potential secondary bearing upon the health of the patient concerned. The late B. A. Thomas, of Philadelphia, was another pioneer in vas injection work, while Rolnick has continued to further the efforts instituted by Belfield. I believe both urologists and roentgenologists should make use of genital-tract roentgenograms as a regular procedure, merging diagnostic with therapeutic measures.

As indicated, in order to give contrast shadows, corresponding in outline only, but of value in diagnosis, of the lumina of the genital and urinary tracts, some radio-opaque substance must be present in the given lumen in sufficient quantity to fill that lumen at least reasonably well. For the genitalia, direct injection would seem the only possibility, and, until recently, that requirement for visualization of the urinary tract has been fairly well obtained by means of liquid media introduced through catheters into either the ureter or bladder. From the time of the early perfection of this method, however, and in spite of its enormous success, urologists have predicted the development of some sort of intravenous administration of medium for contrast shadows. So finally after a period of colorful scientific investigation, including exhaustive experimentation, *intravenous urography* has come into its own. It is being used by all modern urologists, and independently by roentgenologists. I shall endeavor to show why it is not wise for these two groups to use the method independently of one another.

It is interesting to note that one of the sponsors of the most successful medium for intravenous urography was a pioneer with the older, or retrograde, method. I refer, of course, to von Lichtenberg, of Berlin, who, with Swick, brought us a safe and fairly reliable compound in uroselectan, the preparation in more or less common use today.

We have personally had access to it for more than a year, and our successes in intravenous studies have been largely with uroselectan. Another promising drug is skiodan, but, while we have had this in hand for a much shorter period, we are skeptical of its superiority. Its local and systemic reactions are mild to a point of non-existence, but at the present time we cannot depend upon it for good visualization. The third urographic preparation advanced for intravenous use is pyelognost, which was developed by Roseno, in Cologne, and, before uroselectan was available, was used rather extensively by him and others in Germany. I do not know of any extensive practice with this drug in America, but Jarre and I have used it in some sixteen cases, with re-

[1]Read in abstract before the Grace Hospital Staff, February, 1931.

Fig. 1-*A*. Complete urogram, 15 minutes after the administration of uroselectan in a boy aged 14 years, which shows recent injury of the urethra and fracture of the pelvis. Filiform stricture of urethra. Kidneys well preserved. Note distortion of ureters (kinks).

Fig. 1-*B*. Same case: urogram made 15 minutes later. The pelves and ureters are less distended and the ureteral kinks (?) have straightened. The earlier film is undoubtedly taken during "diastole," the second one probably during "systole," or at a period of lesser intrarenal activity.

sults which have heretofore been published, and which will be alluded to later in this paper. Suffice it to say here that we feel it to be definitely too toxic for wide usage, and less reliable as a medium for obtaining good roentgenograms than uroselectan or skiodan.

An important and natural question has arisen as to whether or not intravenous urography will supersede the older method. After we have placed so much faith in the latter for many years, is a new and relatively untried method desirable? The retrograde types of urograms are not perfect, while the newer ones, with an intravenous medium, in many instances, leave much to be desired. Intravenous urography, then, is not to displace the retrograde method, but rather to serve as an adjunct to it. From a different standpoint, intravenous urography was not devised to make it easy for a roentgenologist to render a complete diagnosis in a case with a suspected renal lesion, although his analysis of the film series is of inestimable value; the new method is the product of urology, which in turn reaps the principal benefits of intravenous urography. These lie in the fact that a patient may be spared the added chance of a painful reaction to cystoscopy which is, of course, the necessary preliminary to retrograde urographic studies, except in a small percentage of cases. Also, in some types of cases, cystoscopy is unsatisfactory, and ureteral catheterization unsuccessful, and sometimes dangerous. Parenthetically we may be reminded that renal colic is due to obstruction in the transport passages of the urine, and that catheterization of the ureters, and the

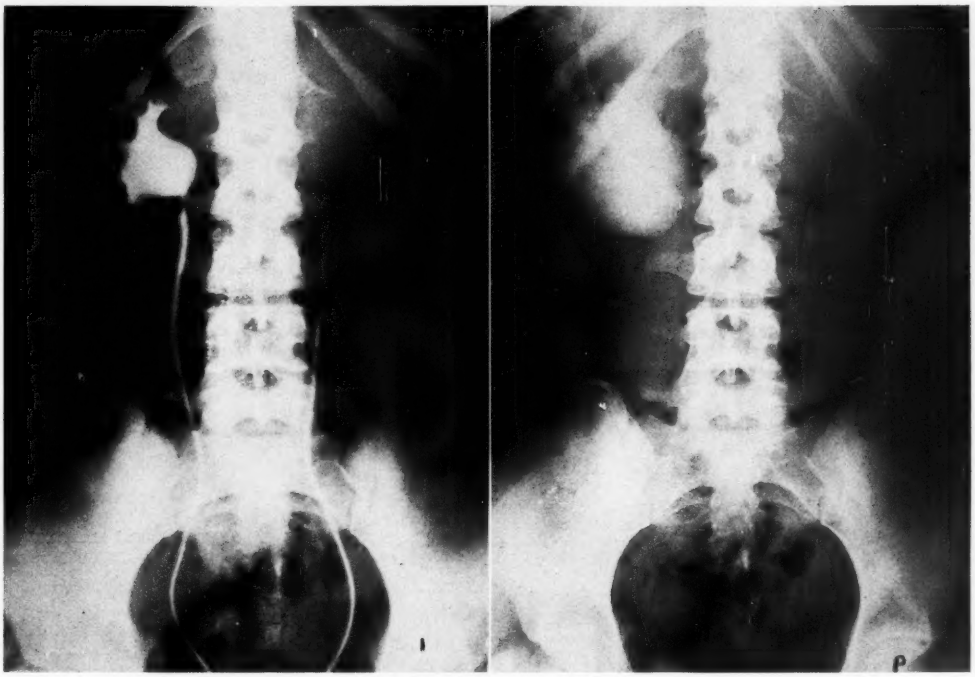


Fig. 2-*A*. Pyelo-ureterogram taken in 1927, showing pyelectasis with stricture at the ureteropelvic junction.

Fig. 2-*B*. The same case, 1931. Bilateral pyelograms taken 30 minutes after the administration of skiodan. The 15-minute film showed excellent pyelogram of better kidney. Note the marked increase in hydronephrosis and failure of ureter to fill. This film is the best of the series for hydronephrosis demonstration.

instrumentation incident thereto, does not often produce colic, which, in the absence of endogenous foreign matter, is brought about by local reaction following the introduction of a contrast medium. This reaction may be edema, spasm, hemorrhage, or a combination of these, and it occurs whether the injection is made with fluoroscopic control, although less often, or by the gravity method or the syringe method. One theoretic contrast is that catheter and retrograde media disturb physiologic activity, while intravenous media do not.

The particular boon of intravenous urography, then, is its applicability for patients who for one reason or another, cannot be subjected to ureteral catheterization, or in whom are found insurmountable mechanical difficulties. We may cite intolerant bladder patients, those with severe vesical neck or ureteral obstructions, those with ureteral orifices in diverticula of the bladder, and those with transplanted ureters, as case illustrations of these types. Another, and important, type is the paralytic bladder group of cases, still fatally infected in most hospitals, in which data relative to the upper urinary tract are sometimes of importance. In this connection, it may be stated that even if a diagnosis in a given case can be made certain by intravenous urography, the later use of cystoscopic manipulations will, in a surprisingly large percentage of instances, be quite necessary.

Uroselectan, and probably skiodan, is apparently filtered through the glomerulus, and

is a sort of index to glomerular function, so that in cases with gross involvement of the renal cortex its use is unsatisfactory. So, also, these drugs fail to produce satisfactory roentgenograms in those disease processes in which for any reason the eliminative activity is in abeyance. We have been disappointed almost uniformly in cases of renal tumor, renal tuberculosis, bladder carcinoma with renal damage and suspected renal or ureteral tumor, acute pyelonephritis, and prostatic obstruction with renal failure. In spite of our experience it is probable that earlier cases of tumor and tuberculosis would have shown sufficient concentration of the medium for worthwhile information, but we are of the opinion that in either disease we will always desire confirmation by means of retrograde studies when they are available, since radical surgery is necessarily involved. A very recent case, with intolerant bladder so acutely inflamed and hemorrhagic as to make recognition of the ureters and catheterization impossible, was studied with pyelognost and, later, skiodan. Carefully timed films over periods of many hours failed to show any shadows of kidney pelves or ureters, in spite of a fair urine output. A diagnosis of bilateral multiple infected infarcts, superimposed upon a severe pyelonephritis, was made, and confirmed at autopsy. Thus we see that all methods of roentgenologic study are subject to failure.

Much was promised in connection with the intravenous media, especially uroselectan, as adjunct functional tests for renal activity. The reports to date have not been convincing and the chemistry involved is too arduous, although some interesting facts were brought out by investigations instituted by us at the Detroit Receiving Hospital. Our method of recovery of the drugs and determinations of their percentages of excretion in given periods will be reported later. It would seem of value to obtain the voided urine following the administration of uroselectan especially, and, by securing samples at as regular intervals as possible, to construct a specific gravity curve as an index to elimination time. In cases of prostatic obstruction we consider all the data available concerning the upper urinary tract of great importance, and intravenous urographic routines have given valuable prognostic data merely by the success or failure to obtain good roentgenograms.

Our personal investigations in this field, with the invaluable aid of the Roentgenological Department, and Dr. Jarre, especially, have brought out one point which seems to be of the greatest significance. It is that the normal individual filters the drugs used so rapidly as not to allow complete visualization of the tract lumina, so that in many normal studies our findings were most imperfect. The use of the Cinex camera, with its many exposures, allows a pieced together picture, which gives fairly complete detail. This camera would provide the ideal means for all intravenous urographic studies. Our original serial roentgenographic findings with pyelognost and uroselectan have been reported before the American Urological Association, and will appear in the official journal of that organization. The most brilliant and successful films have universally been those obtained in cases with good, or reasonably good, renal function on the involved side, but partial obstruction, or apparent obstruction in the ureter or at the bladder neck. Such cases are those with ureteral spasm, stricture, or calculus, often accompanying hydronephrosis; hydronephrosis itself without easily demonstrable block; prostatic obstruction in any of its forms, and urethral stricture. Many other observers have reported the same sort of successes, although it must be added that the original workers in the field, and the current advertisers, give one the impression that any and all kidney pelves and ureters are readily visualized by their partic-

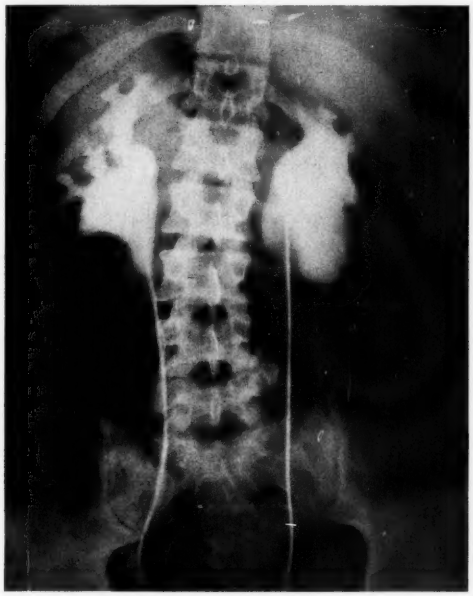


Fig. 3-*A*. Bilateral hydronephrosis, probably congenital. Retrograde studies.

Fig. 3-*B*. Same case in erect posture, catheters withdrawn. Note the extreme rotation and ptosis on the right side. Intravenous studies failed to demonstrate the degree of ureterectasis or any rotation.

ular drug. We are positive upon two points, namely, in normal individuals and in those with temporary or permanent cortical renal damage of an extensive nature, good, readable films cannot be at all regularly obtained. It is in either of these two classes of individuals that the roentgenologist, independently, may be guilty of error in attempting a clinical diagnosis. Careful selection of cases is necessary to avoid great waste of time and material in the practice of intravenous urography and one cannot anticipate with any degree of accuracy if in a given case satisfactory data may be provided. Indiscriminate use of the method should be heartily condemned.

A weakness related to the intravenous technic lies in its lack of aid in determining the so-called emptying time of a renal pelvis and ureter. At the present time when so much stress is being put upon conservative renal and ureteral surgery, in connection with ptosis, hydronephrosis, stricture, and anomalies, the details of physiologic activity are important. In a recent case of bilateral hydronephrosis with extreme ptosis and tenacious infection, our point of departure upon operative interference depended largely on our finding a marked delay in the emptying time of each pelvis. After both kidneys were suspended, the infection was controlled at once. Emptying time determinations with the Cinex camera a few months later seemed to us to be all-important, showing, as they did, very rapid and equal physiologic expulsion of the injected medium. Nevertheless, and rightly, von Lichtenberg states that one is able to interpret the dynamics of the urinary tract by observing the expulsion of uroselectan. He immediately follows this statement, however, by warning that good films may be expected only when the kidney

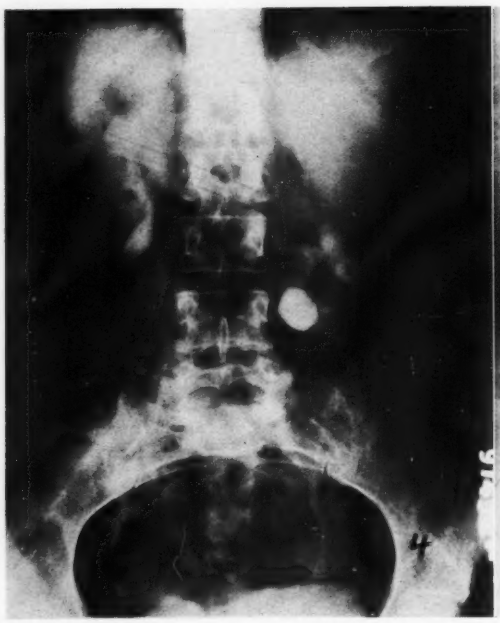


Fig. 4-*A*. Uroselectan urogram showing large stone in the pelvis of the right kidney. This bizarre type of pelvis is well visualized, as are the ureters and the bladder.

Fig. 4-*B*. Lateral exposure showing the same pathology in the same case. (Courtesy of Dr. Weltman.)

function is satisfactory. Only too often we need diagnostic information most when the renal activity is not satisfactory. Von Lichtenberg also points out that the mechanics of the ureter can be studied by intravenous urography, but I submit, as an apparent fact, that these physiologic notations can be made only if and when the intravenous medium concentrates sufficiently in the urinary tract lumina.

As a part of the technic for intravenous work, the early writers advised having the patient under examination void before exposures, so as to allow visualization of the lower ureters in their entirety; later workers have stated that by holding the drug-bearing urine there will be better visualization of the ureters, at least down to the bladder shadow, this being based upon the theory that the full bladder slows the excretion from the ureter. We do not agree with this theory, nor has the practice borne fruit in our hands, although, in some cases of incontinence, failure to secure good roentgenograms was ascribed by our X-ray colleagues to this same incontinence. Other means for the compression of the lower ureteral segments have been widely advocated, principally the use of rubber bags for lower abdominal pressure. This technic has been stressed in England, and lately Herbst, in the American *Journal of Urology,* has spoken of its value. We are unconvinced of the worth of this method, and feel that it may add to the already frequently disturbing factor of flatulence which so often develops rapidly, especially after the administration of uroselectan. To attempt a more direct means of compression we have used air-distended bags in the rectum, keeping

them full during the intervals between exposures. Whether this is an aid or not, we cannot state, since in our hands so many failures still occur. One German writer proposed such a method of compression, and reported it favorably some time after our own experimental use of rectal pressure was begun.

These observations, from a personal standpoint, are based upon the use of—

Pyelognost in 15 cases.

Uroselectan in 83 cases.

Skiodan in 25 cases.

The majority of these intravenous studies have been made in the Grace Hospital, and our early practice was with the use of the Cinex camera in all cases in which good films were found possible. These included a considerable series of normal individuals, and reference has already been made to a report of our findings. Several patients have been examined by this method in several other hospitals. In a number of instances, the drug has been injected in one of our offices, the patient being sent at once to a nearby X-ray laboratory, where films were taken within fifteen minutes of the injection and at stated intervals thereafter. In addition we have had access to uroselectan and skiodan studies made by other local urologists. While there is reason to feel that best results are obtained with many repetitions in the same surroundings and with an exact technic, we believe there is some advantage in the opportunity to observe such a relatively simple procedure in several different places. One may have the co-operation, for instance, of numerous excellent roentgenologic specialists. Our injections have all been made with the gravity method.

Concerning pyelognost, it is necessary to say only that we have discontinued its use. We obtained excellent results in cases with impacted ureteral calculi and early hydronephrosis, but the reaction is rather horrible for the patient, and our percentage of failures was greater than with either of the later drug compounds.

Judging the more than one hundred cases in which uroselectan and skiodan have been used, we may rightfully conclude that for urinary lithiasis, pyelectasis, and ureterectasis, together with the various anomalies, intravenous urography has been gratifyingly successful, provided there has been reasonably good function as indicated by our standard colorimetric and chemical blood analyses. Braasch found the method of value for—

1. Identification of shadows.
2. Determination of the intrarenal situation of shadows.
3. Ascertaining the differential renal function.
4. Demonstration of coincident disease or anomaly in the affected kidney.
5. Determination of the functional capacity and disease or abnormality in the kidney.

In an analysis of forty cases of renal lithiasis, we are particularly in accord with Braasch except that, for differential renal function, intravenous urography cannot be depended upon in our hands. In his series, Braasch observed two cases in which evidence of uroselectan could not be seen in the affected renal area, and in which at operation the kidneys in question were found to be normal.

In addition to our foreign urologists, several in America have stressed the importance of diagnostic data obtained with uroselectan in cases of renal tuberculosis; among these are Lowsley, of New York, and Sweetser, of Minneapolis. We have not had such good fortune, as already stated, but remain hopeful inasmuch as with this disease there are many favorable arguments against ureteral catheterization. Herbst reports a case indicating that his experiences tally with our own as far as positive urographic evidence goes. He also states that in a case

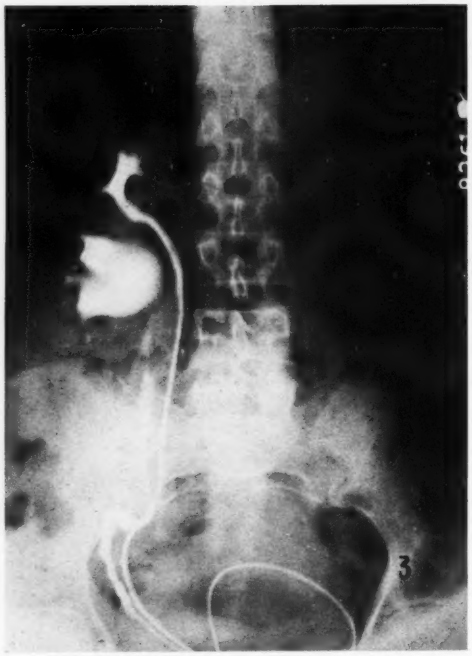


Fig. 5-*A*. Retrograde pyelogram in a double kidney which shows the lower pelvis to be pyelectatic.

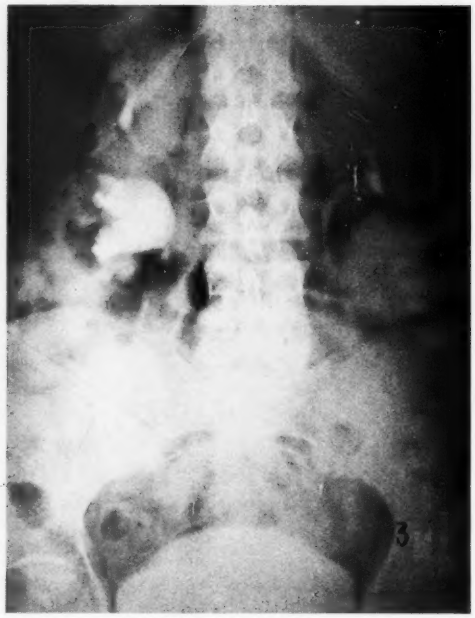


Fig. 5-*B*. Same case; uroselectan study allowing visualization of multiple calculi in the diseased pelvis. The calculi are visible in the plain films. (Courtesy of Dr. Plaggemeyer.)

of polycystic kidney, and in tumor (renal) cases, the pelvic fillings were not sufficient to be of diagnostic value.

Herbst's remarks upon the comparative value of intravenous urography (with uroselectan) are very timely, and we especially admire our former teacher, Bugbee, for his early warning against over-enthusiasm for this type of urography, which he called but a method of corroboration to supplement our proven methods of diagnosis. Viethen, in Germany, Hyman and Beer, in this country, have stressed the value of intravenous urography in children, yet we have found a high percentage of failures with both uroselectan and skiodan.

Since so much of the early work in excretion urography was done with oral administration of contrast media, referring particularly to the efforts of Rowntree and his associates, and since there are some things lacking in our present methods and preparations, it is well to bear in mind that along with the hoped-for improvement in intravenous media may come the evolution of a regularly successful drug for oral use. Several of the foreign writers have discussed this phase of the subject at some length.[2] Oral urography will make its appeal especially for the obscure medical cases undergoing complete study; the intravenous methods have failed rather dismally in our hands, for this type of patient, in contrast to Kidd's prediction of a year ago.

A word is in order as to the relative merits of uroselectan and skiodan. Whereas we have had more experience with the former, there is so little difference in the technic and activity of the two drugs that

[2]See bibliography, page 52.

our finding it a bit more trustworthy seems an accurate observation. Skiodan, however, is cheaper, and can be kept indefinitely after it is put into solution; an older preparation of uroselectan after several sterilizations, even with proper addition of water, produces greater reaction than when freshly used. In the matter of reactions too, there is some difference, since with skiodan there is none whatever, while uroselectan usually causes pain at the site of injection and in the upper arm, along with the well-known though transient general reactions. It appears also, that skiodan filters through the kidneys somewhat more rapidly than uroselectan, a fact which may account for some of its failures with us. As yet there is not much material in the literature concerning skiodan which was informally reported as very successful at the Mayo Clinic a good many months ago. However, Ochsner and Wishard have recently emphasized the importance of taking very early films after its administration, and the manufacturers have stressed this point as of additional value for the drug.

Fig. 6. Uroselectan study, 30 minutes after injection showing complete calcification of the right kidney (healed tuberculosis). The left pyelo-ureterogram and cystogram were excellent. No drug was secreted on right side.

Pyeloscopy, a valuable asset in urography, particularly in the study of pelvic and ureteral function, has been discussed by us in previous articles; it has been often referred to in the foreign literature, especially the French, and several times in our own journals in connection with excretion X-ray studies. It does not appear to fit in very well with intravenous urography, because of insufficient density of the media. We have been able in many cases to determine the most appropriate time for serial films on the Cinex camera with preliminary fluoroscopic study, but cannot get clear detail for evaluation of pelvic or ureteral outlines in most instances. This latter is so nicely possible with retrograde urography that the devotees of pyeloscopy are loath to take up the intravenous methods. With pyeloscopy and retrograde urographic diagnosis, the examination of the patient in both prone and erect positions has become routine. We have without valid excuse failed to practise the taking of exposures in the erect position with many intravenous studies, thereby overlooking an important step for deriving the most value possible from the film studies. It is apparent that this weakness is more or less universal, and we have seen specific instances in which, after definite conclusions had been reached in a given case, further important data were reached only after confirmative retrograde studies in the two positions. In one recent case an intravenous series failed to show much ptosis in the upright posture while a later retrograde film, similarly taken, showed not only marked

ptosis but also an extreme rotation of the kidney.

A tabulated summary of cases subjected to examination by intravenous urography follows:

Total number of cases	123
Classification, without reference to medium:	
Normal subjects	18
Lithiasis	
(a) Unilateral	19
(b) Bilateral	6
Pyelonephritis, subacute and chronic	16
Pyelonephritis, acute	3
Hydronephrosis, with high obstruction	2
Hydronephrosis, with involvement of ureter	8
Hydronephrosis, bilateral	4
Renal tuberculosis	5
Renal tumor	3
Carcinoma of bladder	3
Carcinoma of bladder, ascending infection	1
Reduplication of pelves and ureters	2
Prostatic hypertrophy, with retention	7
Ectopic kidney	1
Extreme nephroptosis	2
Pyonephrosis secondary to ascending infection after spine fracture	3
Urethral stricture	5
Bilateral acute septic renal infarction	2
Acute nephritis, subsiding	1
Tabes dorsalis, with bladder symptoms	3
Cases with single kidney; congenital	1
Studies made for investigation of remaining kidney, with findings as follows:	
(a) Normal	5
(b) Infected	1
Cases following implantation of ureters	2

Obviously we have included a wide variety of lesions; this, together with the normal case studies, was a deliberate attempt to determine the value of the method in routine diagnosis. In the normal subjects, the best results were obtained in those cases examined following nephrectomy (detailed reference to that series has been made in the former paper).

Next in line come the groupings which include ureteral obstructions or obstruction at the bladder neck, or in the urethra.

TABULATION OF CASES WITH REFERENCE TO VARIOUS MEDIA

1. Pyelognost:	
Normal subjects	6
Lithiasis	4
Case following implantation of ureters	1
Suppurative focal nephritis	1
Cases found normal following nephrectomy	2
Infected remaining kidney	1
Total	15

Of this series, the normal group proved almost universal failures. Failure also occurred in the instance of transplanted ureters, and in that of focal suppurative nephritis. Satisfactory films were obtained in one of the nephrectomy series, and three of the lithiasis series, these three being instances of impacted ureteral calculi.

2. Uroselectan:	
Normal subjects	12
Lithiasis	17
Renal tuberculosis	4
Renal tumor	2
Carcinoma of bladder	4
Reduplication of pelves, ureters	2
Acute pyelonephritis	2
Prostatic hypertrophy	5
Hydronephrosis	9
Urethral stricture	5
Pyonephrosis after spine fracture	1
Acute suppurative nephritis	1
Subacute and chronic pyelonephritis	13
Tabes dorsalis	2
Cases with single kidney	3
Case following implantation of ureters	1
Total	83

Omitting the twelve cases which were normal subjects, and one of the cases having reduplication of pelves and ureters, but no pathology, we have a total of 70 cases with disease in the urinary tract; of these, 29, or approximately 50 per cent, did not give films that might be called diagnostic. The groups in which failures were most common include all cases of renal tuberculosis and renal tumor, a large proportion of the pyelonephritis series, and pyonephrosis, both when secondary to spine fracture with ascending infection, and associated with prostatic obstruction and stricture of the urethra. One note the largest series as that of lithiasis, and here we found our best results, the high percentages being in cases with ureteral or small pelvic calculi. Another large group is that of hydronephrosis, and here also we found good results, with the best in the presence of definite ureteral pathology. The cases with low obstruction also gave good visualization when renal function was well preserved.

3. Skiodan:

Renal tuberculosis	1
Lithiasis	4
Acute pyelonephritis	1
Prostatic hypertrophy	4
Hydronephrosis	5
Ectopic kidney	1
Nephroptosis, severe	2
Pyonephrosis, after spine fracture	2
Tabes dorsalis	1
Acute nephritis	1
Subacute pyelonephritis	3
Total	25

In this series also, one notes a wide variety of disease, and may make fair deductions as to the adaptability of the medium for good contrast shadows. Thirteen cases of the 25, or 50 per cent, we have marked as failures. They include the case of ectopic kidney, which incidentally was a single congenital kidney, the cases of acute nephritis and pyelonephritis, that of tabes, which was a patient with good renal function, one case with pyonephrosis after spine fracture, two cases of prostatic hypertrophy, the case of renal tuberculosis, and one case each from the hydronephrosis and lithiasis groups.

In analyzing part of the material recorded here, a few months ago, we classified many of the instances in which intravenous studies were made as partially successful, obtaining a better set of percentages for intravenous urography. We are convinced that this was a bad precedent, and now classify all investigations as either diagnostic or failures. Naturally, in many instances, one kidney and ureter will be visualized while the other is not, but this means diagnostic information, and usually helps in placing the disease process. In this earlier analysis, we tabulated 14 cases in which retrograde study may not have been necessary prior to the institution of therapy as completely diagnosed as to roentgen-ray information. This number was much below the 50 per cent level which our larger group of cases supplies in that it represented cases culled from a total of 38. So one may assume that, by selecting cases for intravenous study, a much higher rate of successes may occur. For the 14 cases cited, a total of 41 cystoscopic procedures, operative and for therapeutic manipulations, were necessary in the periods of treatment. It is evident, therefore, that intravenous urography does not displace cystoscopy in the care of genito-urinary disease.

Fig. 7. Pyelognost urogram, showing excellent demonstration of the bladder and remaining kidney, after nephrectomy.

The habit of illustrating a paper upon our current subject with excellent roentgenograms has become general; it would seem to be a dangerous one, as the casual reader is prone to think that all intravenous urographic studies are as satisfactory. We shall err, however, along the same line, presenting some of our successful films, since the other (and larger) group is worthless, except in relation to the case represented, as negative data.

One step in urography has been neglected, especially in this country, and that is the study of urethrograms. These films, which

are simple in execution, are important in both pre-operative and post-operative phases of bladder neck and urethral obstructive lesions; important, too, in the recognition of diverticula in both sexes. The British urologists have stressed urethrograms, and Young's clinic, in Baltimore, has obtained valuable data by their use.

SUMMARY

The experience represented by 123 consecutive intravenous urographic studies has been recorded in sufficient detail to indicate the value in a new method of diagnosis. Certain types of renal disease have been shown as promising little or no diagnostic evidence after the administration of any of the contrast media now employed. Of these we may mention particularly renal tuberculosis, renal tumor, acute inflammation, and marked renal insufficiency as portrayed by advanced pyonephrosis, septic renal infarction, and advanced prostatism.

Present-day conceptions of the general practitioners in the medical profession include a tendency to over-enthusiasm for intravenous urography, which is not shared by a large group of urologists. It is apparent that this method of diagnosis should not be practised by urologists and roentgenologists independently, and that general laboratories are to be condemned for attempting to place lesions of the genito-urinary tract by means of intravenous urography.

Before uroselectan was available, we used pyelognost in our practice, later continuing, to compare it with the former. More recently we have used skiodan. Of these three preparations we find uroselectan the most satisfactory, and plan to confine ourselves to that drug (now called "Iopax"). It must be admitted that skiodan is better tolerated, but, as has been reported by so many others, and lately ourselves, uroselectan is apparently quite safe. With all three drugs we have seen temporarily alarming reactions.

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NEW RADIUM IN CANADA WILL BREAK WORLD MONOPOLY

That radium to the value of hundreds of millions of dollars, just discovered in Canada, will break the Belgian world monopoly of this precious substance and speed up the relief of cancer victims is the opinion of competent mining experts in Washington.

The pitchblende treasure bearing $150 worth of radium in every pound of ore, discovered by Gilbert Labine and Shirley R. Cragg, airplane prospectors, at Labine Point in the Great Bear Lake region, is equal in richness to the best ores of the Belgian Congo, which since 1922 have driven all competitors, including the United States, from the market.

The new ore is here described by geologists as "a very substantial deposit of high grade material" yielding 3 to 4 grams of radium per ton. Twenty tons have already been shipped on a fur steamer of the Mackenzie River, and forty more tons have been mined and are ready for shipment, at a cost which compares favorably with Belgian freight charges on the long passage from Africa to the refineries in Europe.

Hundred-pound lumps were actually picked up on the surface. The radium from these will yield $70,000 a gram, whereas the most valuable emeralds fetch only $5,000 a gram. Silver ore yielding $300 a ton has been found alongside.

The Canadian discovery, consisting apparently of several thousand tons of ore, will add greatly to the world's present 600-gram total supply of radium. Treatment of cancer, until now hindered by the prohibitive prices, will be greatly helped. — *Science Service.*

THE DEMONSTRATION AND SIGNIFICANCE OF NEPHROPTOSIS AND URINARY STASIS

By HAROLD L. MORRIS, M.D., F.A.C.S., DETROIT

IN the study of urinary stasis of the upper urinary tract, one must be familiar with the normal anatomic relationship of the kidneys and other organs, as well as the supporting structures of the kidneys.

The recognition of nephroptosis, and the various forms of treatment for the same, is as old or older than urology itself; however, the roentgen-ray demonstration of nephroptosis is a more recent development.

It is the purpose of this thesis to again call attention to the anatomic relationship of the kidneys and other organs, as well as the supporting structures of the kidneys, the histologic structure of the renal pelvis and ureter, also the physiologic action of the renal pelvis and ureter. As there may or may not be a stasis of urine in the renal pelvis, as a result of nephroptosis, a method is proposed for determining this factor which should be carried out in cases in which investigation of the higher urinary tract is indicated.

As shown by Southam (1), the kidneys lie in the lumbar region on either side of the vertebral column. Each kidney occupies the

Fig. 1. A motor-driven, tilt X-ray table, with a suitable drain installed at the foot of the table for cystoscopy to be performed with the patient in the prone position, legs extended. The Bucky moves the full length of the table, the tube stand, which is attached to and moves with the table, locks in position over the center of the Bucky. The fluoroscopic screen has underneath two slots for carrying a 10×12 cassette so that films may be made during the course of fluoroscopy, using the fluoroscopic tube for making the exposure

upper third of the lumbar fossa, a space which is bounded behind by the muscles of the loin and back, in front by the peritoneum, above by the diaphragm, and below by the ilium. The kidney extends from the upper margin of the twelfth rib to the lower margin of the second lumbar vertebra. The kidneys are situated entirely behind the peritoneum, and the right kidney lies about a finger's breadth lower than the left. This is said to be due to the fossa on the right side being less capacious on account of the pressence of the liver and an inclination of the vertebral bodies to that side.

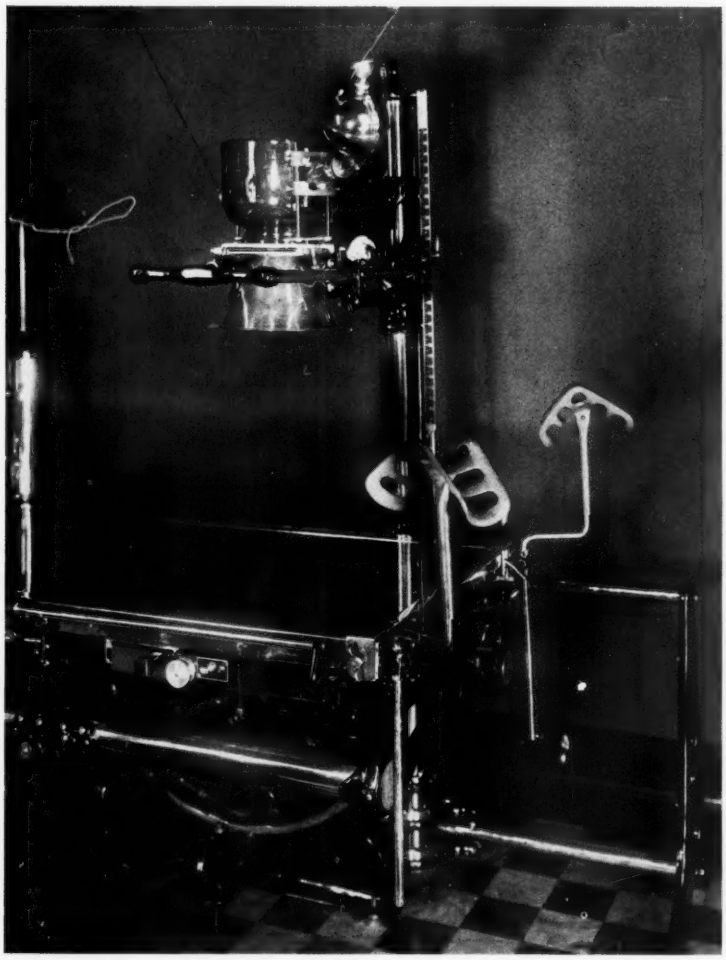


Fig. 2. Shows a similar type of X-ray table to the one shown in Figure 1, with the stirrups at the foot of the table. After the cystoscopy is completed the patient is suitably placed on the table, the stirrups removed, and the foot rest placed in position. Pyeloscopy and pyelography are then carried out in the usual position.

The peritoneal relations are somewhat different on the two sides. On the right side

Fig. 3-*B*. After the renal pelvis is well visualized fluoroscopically the catheter is withdrawn to just outside the ureteropelvic sphincter and films are made with the fluoroscopic tube, without the Bucky diaphragm. In almost all instances a much clearer outline of the pelvis is thus obtained for permanent records than with the usual procedure on a larger film with the Bucky.

Fig. 3-*A*. The tip of the ureteral catheter in the correct position within the renal pelvis. With the catheter thus placed, slow injection of pyelographic medium results in no spasm of discomfort to the patient, neither is there an over-distention, with resultant spasm, whereas, the entire filling is readily seen fluoroscopically.

the peritoneum passes from the liver to the anterior surface of the kidney; the lower third of the kidney is not covered by peritoneum. The area of the left kidney covered by the peritoneum is far less than that of the right kidney.

The upper third of the left kidney is related to the stomach, while the pancreas crosses its middle third; the lower third is covered by peritoneum and related to coils of small gut, the outer border being related to the spleen above and the colon below.

The upper two-thirds of the right kidney is covered by the under surface of the liver, the lower third by the hepatic flexure of the colon. The inner border is related to the duodenum.

The posterior surfaces of the ascending and descending colon are not covered by peritoneum, and hence the gut comes into relation with the perirenal fascia. The suprarenal gland rests upon the upper pole of the kidney, while posteriorly the kidney lies upon the quadratus lumborum and psoas muscles, the diaphragm, and the transversalis aponeurosis.

If the lumbar regions be examined from behind, it will be seen there is a difference in outline in the two sexes. In the female, the lumbar region broadens out below and

has the appearance of a cone with the apex above, while in the male it is more cylindrical in shape and tends to become narrower below. This is due to the increased breadth of the female pelvis, and in some cases an acquired narrowness of the lower costal margin. In the male, the lower ribs are more horizontal and the chest has a greater width, while the measurement across the iliac crest is relatively small. In the female, the intercristal diameter of the body may be greater than the transverse diameter of the lower thorax by two and one-half centimeters. In males, the fossæ are distinctly pear-shaped and become narrower below, while in females they are relatively narrow above and broaden out below or are cylindrical in shape. Further, a comparison of the fossæ on opposite sides of the body shows the right recess is usually a little larger than that on the left side.

In most cases the fossa of the right side is more capacious than that on the left. Southam demonstrated this fact by making transverse sections of the casts, cut with a band-saw at the level of the first lumbar vertebra. In the male, the right recess was thus shown to be appreciably larger than the left; the average measurement in the right side being about two centimeters broader than the left at the level of the first lumbar vertebra. The fossa of the right side is deeper than that of the opposite side at the same level by one centimeter.

The upper end of the kidney is rather greater than the lower in circumference, more curved, and nearer to the vertebral column. It corresponds to the intervertebral disc between the eleventh and twelfth thoracic vertebræ. The lower end is bounded by the intervertebral disc between the second and third lumbar vertebræ.

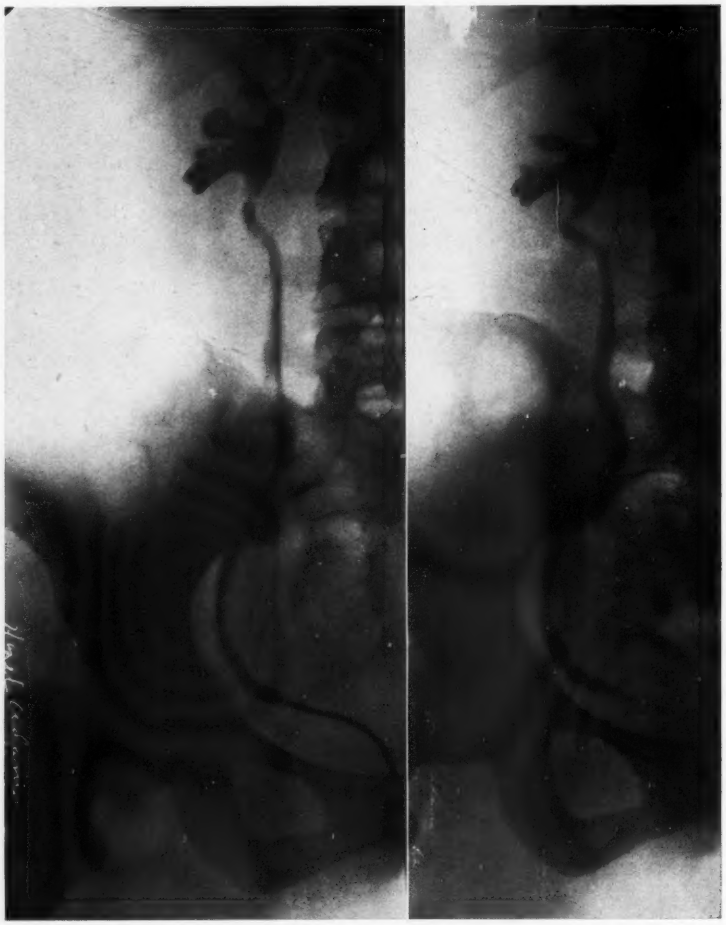
The fixation of the kidney depends on two factors: first, the fatty capsule through which runs connective tissue fibers from the fibrous capsule to Gerota's capsule; second, Gerota's capsule. This is the fascial envelope which surrounds the kidney, and is quite distinct from the fibrous capsule of the kidney which closely invests the organ and lines the renal sinus. This is sometimes also called the fascia renalis, fascia propria,

Fig. 4. The catheter in this film has been withdrawn into the upper ureter and the point of narrowing is very readily seen at the ureteropelvic sphincter.

Had a catheter been inserted no farther than this and injection of pyelographic medium begun, one of two things would have happened: either the fluid would have returned alongside the catheter, or, if the catheter was of sufficient caliber to occlude the ureter, then dilatation of the ureteropelvic sphincter would have resulted in rather marked renal discomfort and spasm.

Films reproduced in Figures 3-*B* and 4 were made with the fluoroscopic tube, having the cassette on the anterior surface of the body without the Bucky diaphragm.

tunica fibrosa, capsule of Kustner or Zuckerkandl, and consists of a thin sheath of fascia which completely surrounds the kidney and suprarenal body. The sheath is separated from the kidney by a layer of fat lies between the peritoneum and the anterior surface of the kidney. Where it comes into relation with the peritoneum the two layers are closely blended together; where, however, the peritoneum is absent, it is related



Figs. 5 and 6. Pyelo-ureterograms in the prone and vertical positions.
Note the ureteropelvic sphincter in the prone position, and the angulation in the ureter just below the ureteropelvic junction.
In the vertical posture, however, this was not sufficient to interfere with normal emptying of the renal pelvis while the patient was standing.

within which the kidney is embedded and consists of two layers, an anterior and a posterior layer.

The anterior, perirenal layer, or fascia of Toldt, is a thin, fibrous membrane which to the neighboring viscera, the posterior layer, or fascia overlying the lumbar muscles. At the inner border of the kidney this layer reaches to the vertebral column and becomes firmly attached to the bodies of

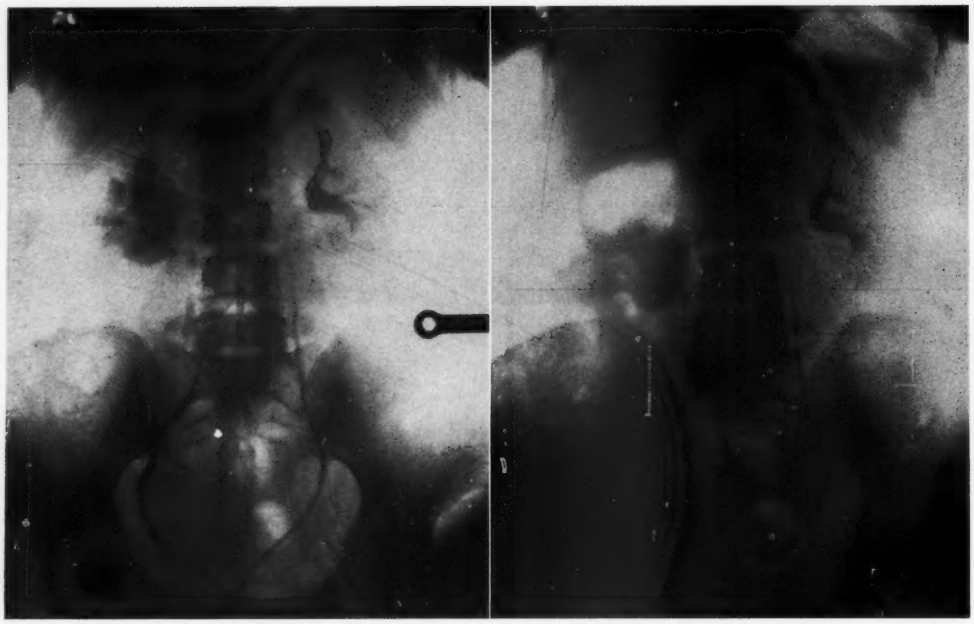
the vertebræ in front of the origin of the psoas muscle. The anterior layer merges with connective tissue elements at the root of the mesentery and around the great vessels. This layer does not extend beyond that point to cross the midline to the opposite side. Above the hilum these two layers come together at the inner border of the kidney, being separated only by a deposit of fat; the posterior layer then becomes attached to the spinal column and the anterior ends as already described. At the level of the hilum they are kept apart by the renal vessels, while below, the ureter lies between them as it passes down to the pelvis.

At the outer border of the kidney, the two layers of fascia come together and join each other, forming a well marked band which passes out behind the peritoneum to join with the transversalis fascia. It forms an important means of fixation of the kidney. Other accounts of the arrangement of the

Figs. 7 and 8. Bilateral pyelo-ureterograms in the prone and vertical postures, showing a rather decided loop in the upper ureter in the upright posture, and quite a decided angulation in a similar position in the prone posture.

These deformities in the ureteral outline were found to be due to an aberrant artery to the lower pole of the kidney.

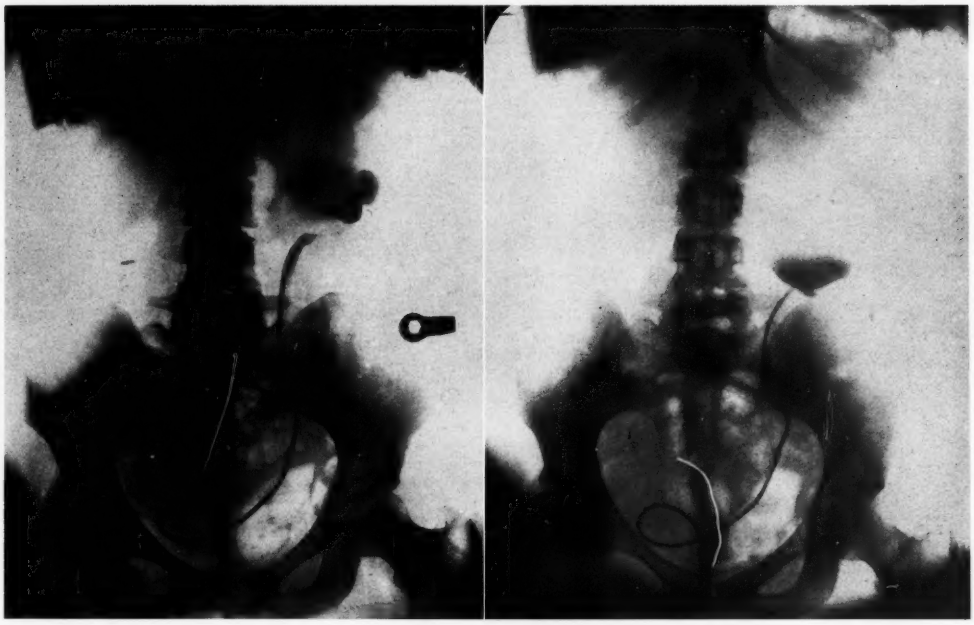
In this case there is a very definite renal stasis and interference of emptying of the renal pelvis, especially in the upright posture.



Figs. 9 and 10. Bilateral pyelo-ureterograms, prone and vertical positions, revealing a very decided retention in the right renal pelvis, accompanied by infection. At operation an aberrant vessel was found in the lower pole of the kidney, crossing the ureter in its upper third in such a way that, after the vessel was severed, the pelvis readily emptied.

fascia at the outer border of the kidney are singularly incomplete. Cunningham states that the walls of the sheath come in contact and are connected with the retroperitoneal tissue. Thomson Walker merely states that the perirenal fascia appears between the transversalis fascia and the peritoneum and divides into two layers, while Kelly and Burnham find the two layers unite at varying distances and then pass forward under the peritoneum. Sir Henry Morris says it ends indistinguishably in the subperitoneal fascia, and Poirer states that the fascia is closed at the outer side, mentioning no specific attachments.

The anterior and posterior layers, after enclosing the kidney and suprarenal body in one compartment, join together at the upper pole of the suprarenal and pass up as a single strong band to unite with the tendinous area of the diaphragm. There is thus formed a strong suspensory band for the kidney when the body is in the erect posture. The suprarenal is attached to the upper pole of the kidney by fibrous strands. The third support of the kidneys is the pressure exerted by the abdominal viscera; the fourth, the muscular tone and development of the abdominal walls; fifth, the nephrocolic ligament, and sixth, the kidney pedicle. The accessory factors such as the phrenocolic, hepatorenal, the duodenorenal ligaments, as well as adhesions between the spleen and kidney, deserve mention. The kidney normally moves during respiration, rising and falling with the action of the diaphragm. Earlier writers thought the kidney was a fixed organ, but Glenard, in 1899, showed that the organ moves with respiration. Kelly and Burnham state that the normal up-and-down movement during respiration varies from one to five centimeters; Thomson Walker observes the excursion varies from one-half to one and one-half inches. Rosen-

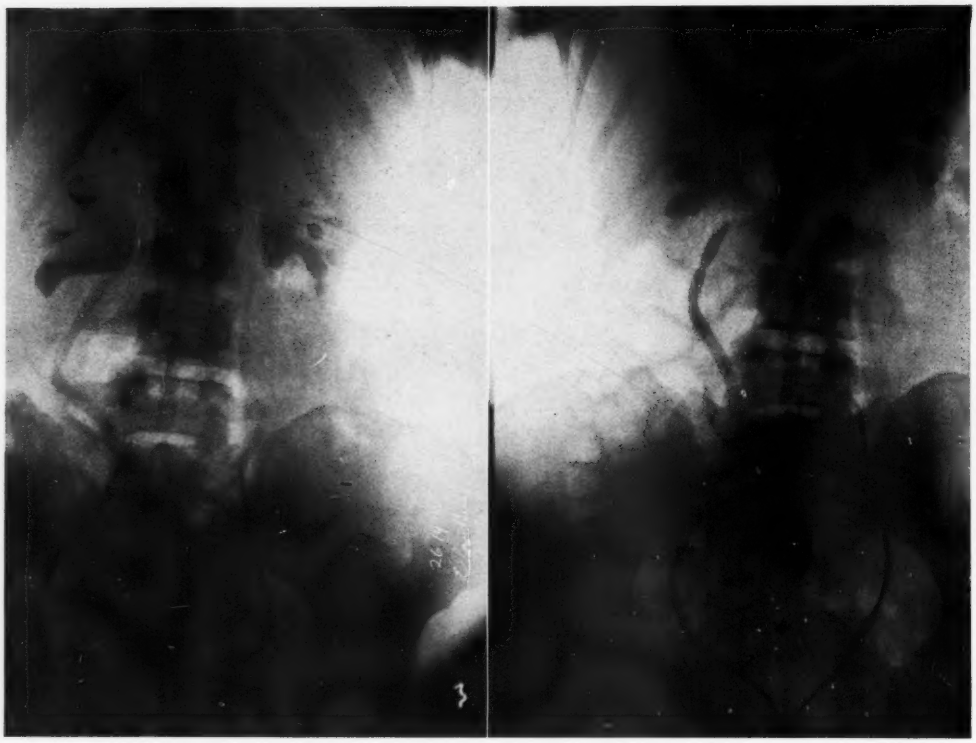


Figs. 11 and 12. Left pyelograms in the prone and vertical positions showing a large hydronephrosis, the hydronephrotic sack not being clearly outlined in these films. However, there was a very decided retention, with little or no infection. At operation an aberrant vessel was found in the lower pole of the kidney; after this was severed, the renal pelvis readily emptied.

thal showed that in the female the kidney has a greater range of movement; this has been considered as due to the shape of the renal fossa in this sex. On deep inspiration and expiration the renal pelvis rises or falls to the same extent as the diaphragm. In patients with enteroptosis the amount of displacement is increased and the degree of nephroptosis is readily detected. The right kidney moves more freely than the left, probably because the movements of the diaphragm are more directly transmitted to it through the liver, which descends into the renal pouch with each inspiration.

The movable kidney may be described as one which moves with abnormal freedom behind the peritoneum. The earliest reference in medical literature on the subject of movable kidney is found in the writings of Meuse, of Venice, who wrote a chapter on this subject in 1497, of Francis Pedemontanus, in 1581, and of Riolan, in 1682. Riolan observed that the normal condition of the kidney is a fixed one in the flank, but that under certain conditions it becomes movable, and that stones or growths in the kidney especially favor the loosening. Rayer, in 1846, in his work "Diseases of the Kidney," reported seven cases of mobile kidney, which he thoroughly studied, not only from the anatomic but from the clinical standpoints of diagnosis, symptomatology, and treatment. He noted that the conditions were commoner in females than in males, and that it affected more frequently the right kidney. He also noted that pregnancy and heavy lifting were contributory causes, and that patients were usually thin and hypochondriac. Finally he stated that in some cases bandages gave relief. In 1864, Dietl described the crises found in certain cases of mobile kidney and gave to the literature the term "Dietl's crisis."

The first operation performed for mov-



Figs. 13 and 14. Bilateral pyelo-ureterograms in the prone and vertical positions showing bilateral pelvic stasis and at operation an aberrant vessel in the lower pole of each kidney was found. This is the only situation I have observed in which aberrant lower polar vessels were bilateral.

able kidney was by Martin, of Berlin, in 1878, when he carried out nephrectomy in two cases. Suspension of the organ was first carried out by Hahn, of Berlin, in 1881. His lead has been followed by many operators, and a vast number of operations have been devised to secure fixation of the kidney. Glenard, in his writings in 1885 and 1900, maintained that movable kidney was not a condition in itself, but part of a general enteroptosis, due to congenital weakness of the supporting structures of the abdominal viscera. Landau, in 1881, had maintained that the kidney was normally fixed and any degree of mobility was abnormal. This, we now know, is not true, as the organ moves with respiration.

More recently, Fita, Dell, Treves, Goelet, Suckling, Billington, Newman, Edebohls, and Lane have added to the literature on this subject, while Sir Henry Morris and Sir William Roberts have contributed valuable additions to our knowledge. Up to 1901, Sir Henry Morris had performed 98 nephropexies with one fatal result.

Sappey and Zuckerkandl, in 1883, described a thickening of the connective tissue on the posterior surface of the fat capsule of the kidney, which he called the fascia retrorenalis. Gerota, in 1895, described a layer on the anterior surface, which he called the fascia perirenalis. The fascia is more marked on the left side, and this fact was first demonstrated by Toldt. Apart from this, little original work on the fascial attachments of the kidney appears to have been done.

In all writings on motility of the kidnev

Figs. 15 and 16. Bilateral pyelograms in the prone and vertical postures, made with the fluoroscopic tube on 10 × 12 films, without the Bucky diaphragm, which gave a clear visualization of the higher urinary tract. These can easily be made during the course of fluoroscopic study. Although there is a pronounced right renal ptosis in this instance, the pelvis was found to empty normally, there being no stasis or infection. This type of case is greatly relieved by the wearing of an abdominal support.

up to a comparatively recent date, the diagnosis depended largely on palpation and percussion, X-ray examination of the gastrointestinal tract, and observations of various surgeons when operating within the peritoneum. As a result a long list of symptoms as well as diseases has been attributed to ptosed kidneys, with resultant urinary stasis.

Bailey (*2*) states: "The kidney pelvis, with its subdivisions, the calices and the ureter, constitutes the main excretory duct of the kidney. Their wall consists of three coats: an inner mucous, a middle muscular, and an outer fibrous."

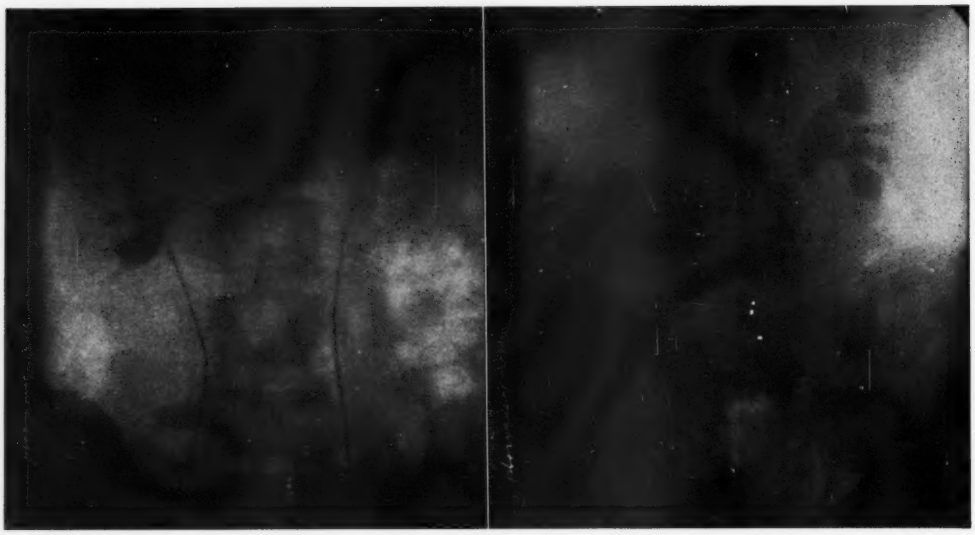
The mucosa is lined by epithelium of the transitional type. There are from four to eight layers of cells, the cell outlines are usually well defined, and the surface cells, instead of being distinctly squamous, are only slightly flattened. Less commonly, large, flat, plate-like cells, each containing several nuclei, are present. Diffuse lymphatic tissue frequently occurs in the stroma, especially of the pelvis. Occasionally the lymphatic tissue takes the form of small nodules. Mucous tissue takes the form of small nodules. Mucous glands in small numbers are found in the stroma of the pelvis and upper part of the ureter. There is no distinct submucosa, although the outer part of the stroma is sometimes referred to as such.

The muscularis consists of an inner longitudinal and an outer circular layer. In the lower part of the ureter a discontinuous outer longitudinal layer is added.

The fibrosa consists of loosely arranged connective tissue, containing many large blood vessels. It is not sharply limited externally, but blends with the connective tissue of surrounding structures, serving to attach the ureter to the latter.

The larger blood vessels run in the fibrous coat. From these, branches pierce the muscle layer, give rise to a capillary network among the muscle cells, and then pass to the mucosa, in the stroma of which they break up into a rich network of capillaries. The veins follow the arteries.

The lymphatics follow the blood vessels,



Figs. 17 and 18. Bilateral pyelo-ureterograms made with the fluoroscopic tube, without the Bucky diaphragm, in the prone and vertical postures, showing a bilateral ptosis with bilateral stasis and bilateral pyelitis.

In this case, as well as the preceding one, with the patient in the vertical posture, the palpating hand on the abdomen could easily replace these kidneys to normal position while being observed fluoroscopically; however, without this aid there was definite stasis present.

being especially numerous in the stroma of the mucosa.

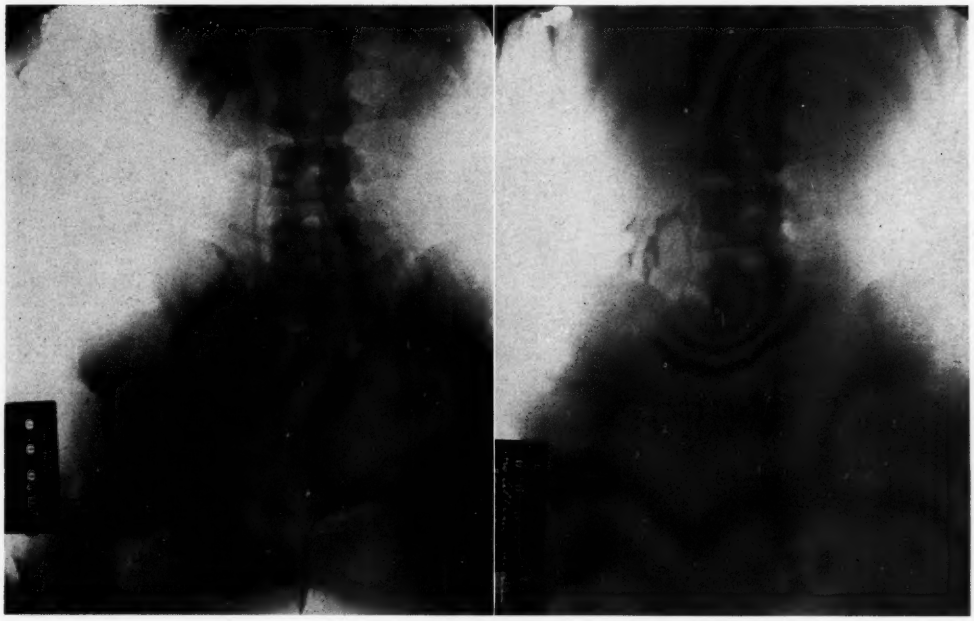
Nerves.—Plexuses of both medullated and non-medullated fibers occur in the walls of the ureter and pelvis. The non-medullated fibers pass mainly to the cells of the muscularis. Medullated fibers enter the mucosa when they lose their medullary sheaths. Terminals of these fibers have been traced to the lining epithelium.

Bearing in mind the histologic and anatomic data, it is much easier to consider the subject of pyeloscopy because by this procedure we actually see the motion and physiologic phenomenon of the emptying of the renal pelvis and are brought to realize that the normal renal pelvis and ureter undergo very definite rhythmic contractions and dilatations, whereas many variations are encountered and observed in the abnormal.

It really is surprising how little has been written and how little description given of the physiologic action of the renal pelvis and ureter, even though the anatomic and histologic structure is well known. As an example of the text-book teaching, Stewart (3) states the following: "Trickling along the collecting tubules, the urine reaches the pelvis of the kidney, from which it is propelled along the ureters by peristaltic contractions of their walls and drops from their valve-like orifices into the bladder."

Muschat (4) presents data which demonstrate rhythmic contraction of the spiral muscle of the renal papilla. It seems highly probable that this muscle causes an act of suction on the papillary duct, which milks the renal papilla. The force of the contraction varies for each preparation, but the time relation for contraction remains the same, about every thirty seconds.

Young (5) says: "The urine passes along through the ureter from the kidney as the result of peristaltic waves which originate in the musculature of the pelvis, and extend to the ureterovesical orifice."



Figs. 19 and 20. Right pyelo-ureterogram in the prone and vertical postures reveals a normal appearing ureter and renal pelvis in the prone position; however, in the vertical position there is a very decided ptosis. This situation is one frequently encountered in patients who have persistent right abdominal discomfort, for which many have a "chronic appendix" removed.

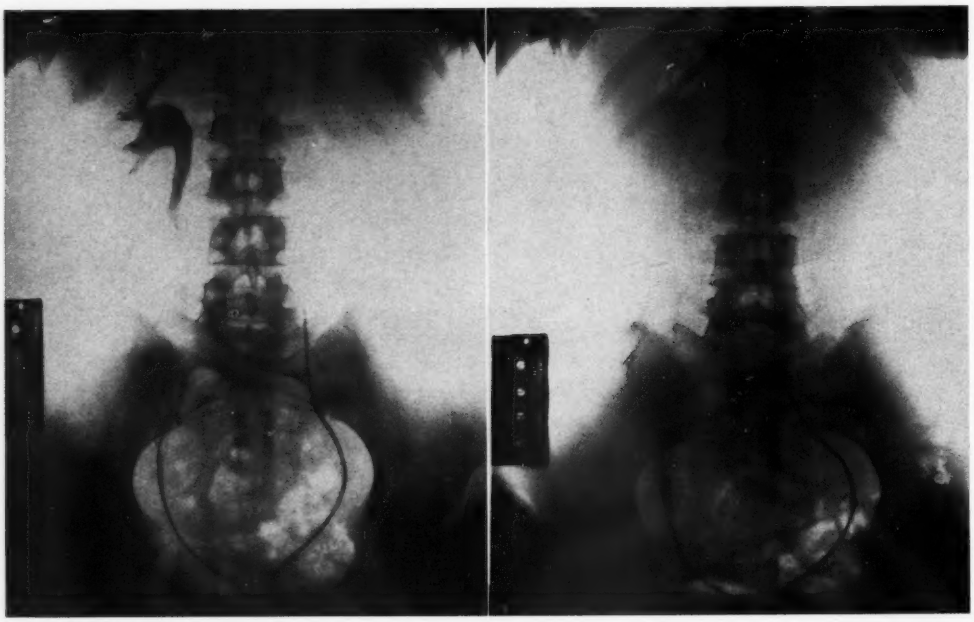
Figs. 21 and 22. Left pyelo-ureterogram showing a rather decided dilatation of the renal pelvis and irregularity of the minor and major calices, suggestive of acid-fast infection. However, there is no abnormal ptosis and the ureteropelvic sphincter and upper ureter show nothing to account for the pelvic dilatation.

Fig. 23. Right pyelogram made during the later months of pregnancy, showing a marked dilatation of the upper one-half of the ureter and renal pelvis.

Our present knowledge of the movements of the ureter dates back to the classic studies of Engelmann (6), published about sixty-two years ago. His careful studies were made by simple ocular observation of the movements of the ureter in the dog, cat, rabbit, and rat. Engelmann made the statement that in the dog the movements might be studied by the graphic method; he, however, did not carry out such experiments.

Lucas made a rather exhaustive study of the physiology and pharmacology of the ureter in the dog by the graphic method. The essential points of his study of the ureter of dogs, by the graphic method, he summarized as follows:

"Even under morphin anesthesia the middle part of the ureter (comprising at least two-thirds) shows comparatively large contractions which recur, if the urine is permitted to flow unimpeded into the bladder,



Figs. 24 and 25. Right pyelogram of the same patient as shown in Figure 23, made 7 months after delivery, showing some dilatation in the upper third of the ureter and some dilatation of the renal pelvis. However, the minor calices are normally cupped. The upright posture shows a very marked ptosis. This is a very common finding in pyelitis of pregnancy.

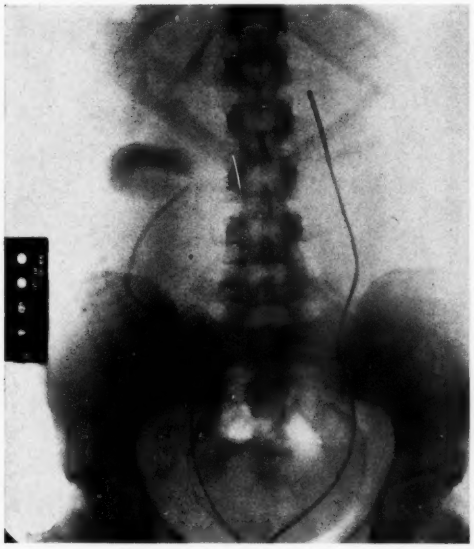


Fig. 26. Right pyelo-ureterogram made during the latter months of pregnancy because of severe, persistent hematuria.

Fig. 27. The patient shown in Figure 26 refused surgical interference and two years later returned for observation and this megalo-ureter was seen fluoroscopically to fill. However, pyelographic medium could not be introduced into the renal pelvis.

at intervals varying from six to twenty seconds.

"The renal pelvis and the uppermost part of the ureter show contractions of another type, namely, small oscillations which recur much more frequently than the larger contractions.

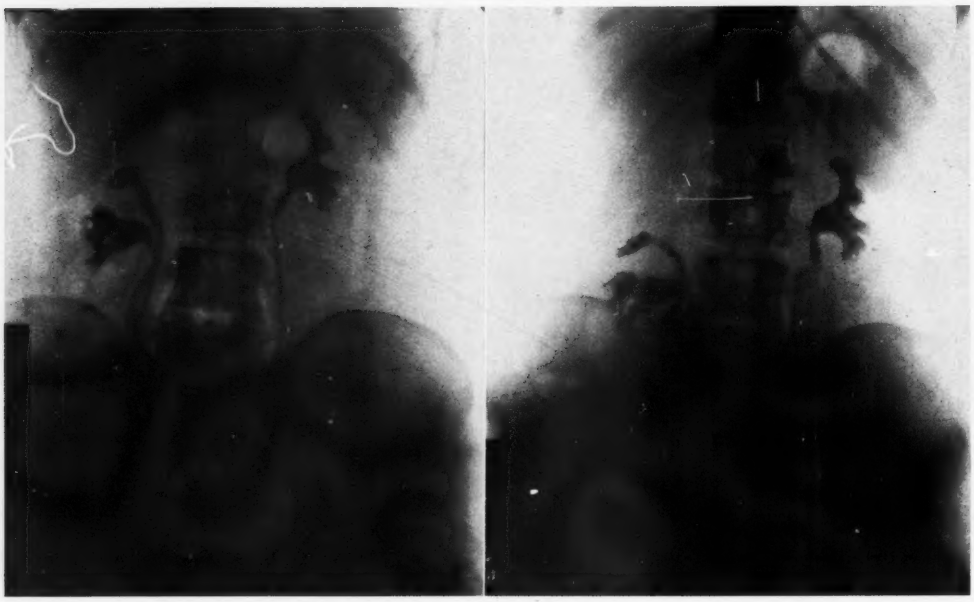
"Chloroform and ether affect profoundly the large contractions of the ureter, so as even to abolish them completely, while the smaller oscillations show a greater resistance towards anesthetics."

The clinical value and practical application of the physiologic function and activities of the renal pelvis have been called to our attention by two clinicians, one a roentgenologist in this country, Manges, and the other a urologist in Paris, Legueu.

The fluoroscopic visualization of the higher urinary tract is now a practical procedure. The roentgenologist of to-day not only reports the findings as portrayed by the pyelograms of the renal pelvis and ureter, but he also includes his fluoroscopic observation as he does a study of the gastro-intestinal tract.

We are indebted to Manges (8) for demonstrating and calling to our attention the advantages of pyeloscopy combined with pyelography, and to him credit should be given for having coined the term "pyeloscopy," for, as he states: "Pyeloscopy is but a preliminary to pyelography, and adds distinctly to the comfort of the patient, as well as the safety and the accuracy of the entire procedure." Seventeen years later, he added: "That is just as apt and fair a statement of reason for advocating the method to-day as it was then." Pyeloscopy, then, is indicated in every, and not only in the exceptional or selected, case.

In 1911, Manges (9) began to study the urinary tract by means of pyeloscopy as an aid to pyelography, and to date has never allowed the making of pyelographic films



Figs. 28 and 29. Bilateral pyelo-ureterograms in the prone and vertical postures showed a bifurcation of the right ureter with two pelves on the right side.

There is some dilatation and definite clubbing of the minor calices of all three pelves in the prone position; however, in the vertical posture, the minor calices in the superior pelvis on the right side, which were before very much blunted, are now normally cupped.

without fluoroscopic control and study as the injection is being made into the ureter or renal pelvis.

If one is to determine the degree and amount of renal stasis, this can be satisfactorily accomplished only by the aid of the fluoroscope before making pyelo-ureterograms. The interpretation, therefore, largely rests with the roentgenologist and from his reports, plus the clinical evidence and the urologic findings, the urologist is able to draw a much more satisfactory conclusion with regard to treatment and further procedure.

In spite of the fact that pyeloscopy has been practised by Manges for the past twenty years, and his technic described in various journals, the roentgenologist has been slow to provide adequate equipment to carry out this procedure, with the result that pyeloscopy is made very little use of in this country.

In the past three years, the urologist has had the advantages of pyeloscopy most forcibly brought to his attention by the work of Legueu (10) in whose monograph the physiologic action of the renal pelvis and ureter is very strikingly presented. All of this one can easily see for himself, when fluoroscopic studies are made of the renal pelvis. Once having visualized the higher urinary tract, one would never be satisfied to continue the old method—working in the dark and not knowing where the ureteral catheters were; the presence or absence of stone; when the renal pelvis has enough solution for good films without over-distention of the pelvis, and resultant pain to the patient.

The very recent, original, and valuable contribution of Jarre and Cumming (11) has added to our knowledge immensely. Their appreciation of motor function and physiologic action of the renal pelvis and ureter was recorded by a Cinex camera, us-

Figs. 30 and 31. Bilateral pyelo-ureterograms in the prone and vertical postures show a rather decided right renal ptosis. Fluoroscopy revealed a definite stasis.

This girl has had several major abdominal operations, none of which has relieved the right abdominal discomfort. An abdominal support was worn for some time without relief, and nephropexy was advised.

ing a five-inch film band for a unilateral study and a ten- to twelve-inch film band for a bilateral study.

As stated by Jarre (12), "The purpose of this presentation is to stimulate interest in those physiologic problems which concern medical roentgenology, with the expectation that we may derive therefrom a better conception of organic and functional normalcy and disease, and thus may improve roentgenologic diagnosis.

"Two groups of phenomena lend themselves to physiologic roentgenologic investigation: (1) Those of motion which can be rendered radiovisible, and (2) phenomena of concentration and secretion of opaque substance as they are classically demonstrated by cholecystography.

"Whenever a tubular viscus is rendered radiovisible, one should study its function as well as its anatomic structure, since the evaluation of its physiologic behavior must be considered as equally important as—possibly even superior to—anatomic information. The omission of such observation will be regarded as negligence in medical practice of the future."

Having considered somewhat at length the anatomy, histology, and physiology of the upper urinary tract, one can now proceed with the factors pertaining to renal or ureteral stasis and the means of diagnosis at hand.

The first requisite is suitable equipment for roentgenologic study, and the table (13) which I have found most satisfactory is a motor-driven, tilt table, with the Bucky travelling the full length of the table and the fluoroscopic screen movable over the upper two-thirds.

Cystoscopy and ureteral catheterization may be carried out on the X-ray table, or

the patient may be cystoscoped and then placed upon the X-ray table. With the Bucky at the foot of the table, the fluoroscopic screen is brought into place over the abdomen, the ureteral catheters located and note made of their position, relation to opaque bodies such as calculi, and the relative position in the renal pelvis.

The medium used heretofore for visualization of the renal pelvis and ureters has been sodium iodide 12 per cent, 20 per cent, or 30 per cent. However, as this solution is more or less irritating to certain individuals, recently, use has been made of uroselectan or skiodan for injecting into the renal pelvis. These are practically non-irritating to the mucosa of the renal pelvis, ureter, and bladder. Then 0.5 c.c. of solution is injected through the catheter, this amount being sufficient to locate the tip of the catheter and its relation the renal pelvis, whether it is below the ureteropelvic sphincter, within the pelvis proper, or in one of the major calices. Severe pain may follow the injection of a greater amount of fluid if the catheter tip is below the ureteropelvic sphincter or if the tip of the catheter is within one of the major calices and a sudden over-distention of that particular calyx takes place.

Often the entire renal pelvis is clearly outlined, especially if one of the more concentrated solutions is used, upon the injection of only 0.5 cubic centimeter. Up to this time there has been no pelvic spasm with resultant discomfort. After the initial injection of one-half c.c., 1 c.c. at a time is added until the entire pelvis is clearly outlined. At this time 10×12 films are made, using the fluoroscopic tube and placing the cassette under the fluoroscopic screen in the holder designed for this purpose, without a Bucky diaphragm. As a rule a more clear-cut image of the pelvis is thus obtained than when 14×17 films of the entire genito-urinary tract are taken with the Bucky.

During this part of the examination the degree of respiratory excursion of the kidney is noted and the patient is then placed in the erect posture and the actual amount of excursion from the prone to the vertical position is observed.

It will be noted that many renal pelves readily empty even though there is an abnormal amount of motility with resultant tortuosity of the ureter. In the erect posture, should there be a delay in the emptying of the renal pelvis, by means of counter-pressure with the hand of the operator on the abdomen the kidney can easily be elevated and then one sees the normal process of emptying continued.

In another instance there may be little or no appreciable excursion of the kidney, and yet in the erect posture there is a delay in emptying. This may be due to fixation of the upper ureter and even so little downward descent of the kidney is ample to prevent normal emptying with resultant stasis of varying degrees.

I am of the opinion that the respiratory excursion of the kidney in the prone position is not a true index of the condition in the erect posture, and I also am convinced of the advisability and necessity of palpation of the kidney in both the prone and vertical positions while making routine physical examination before it is concluded that the kidney is not palpable or tender or that fist percussion reveals no tenderness in the renal region.

Having noted the renal motility in the erect posture, the next problems to decide are: *(A)* Is there any retention or interference with the normal emptying of the renal pelvis while in the erect posture? *(B)* Does the renal pelvis normally contract and relax when the kidney is elevated by the hand of the operator? *(C)* Is the kidney fixed or rotated so that stasis results? These questions can most satisfactorily be settled only with a table that places the patient in the standing position. I do not believe that the sitting posture with the thighs flexed will

give as true a degree of motility and resultant dysfunction as the standing position.

By this means we then have a correct conception of the physiologic function of the renal pelvis, and are enabled to say, with some degree of accuracy, which patient should be subjected to nephropexy, which will be benefited by the proper kind of abdominal support (as we see many kidneys that come well down to the crest of the ilium or below), and which function properly and have no stasis when elevated to their normal position.

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EAR COMPLICATIONS IN ACUTE CRANIOCEREBRAL INJURIES

A STUDY OF 476 CASES

By E. S. GURDJIAN, M.D., PH.D., DETROIT, MICHIGAN

EAR complications are frequent in cases of skull fracture with brain injury. In a series of over 2,600 cases seen at the Receiving Hospital, Detroit, within a period of five years (1925-1929), there were 476 cases with bleeding or cerebrospinal fluid leakage from either or both ears. The accompanying tabulation (Table I) shows that the left ear is more frequently involved and that with unilateral bleeding the mortality is approximately 38 per cent. With bilateral discharge, the mortality rises to 67 per cent. These figures are astonishingly similar to those reported by Davis (1). However, unlike his experience in cases with cerebrospinal fluid leakage from the ear, the results in this clinic have been much better, the mortality being near 50 per cent. It is undoubtedly true that a certain number of cases with cerebrospinal fluid leakage are not diagnosed because of the presence of blood in the discharge and because, in the majority, the discharge stops very soon after the accident. It should be remembered that there may be bleeding into the tympanic cavity with no associated rupture of the membrane. In such cases, the blood may show in the nasopharynx, escaping the middle ear through the eustachian tube. Bleeding from the ear does not always imply fracture through the petrous bone. There may be a rupture of the membrane caused merely by pressure changes with consequent bulging or retraction of the membrane during the accident. However, as will be brought out later, bloody discharge from the ear is in the majority of cases associated with a fracture somewhere in the skull. In our experience the bleeding usually stops within a few hours after the accident. Occasionally one sees persistent bleeding for several days. In some cases with profuse bleeding the possibility of lateral sinus, jugular bulb, or middle meningeal artery rupture into the middle ear should be kept in mind. In a series of 1,000 cases of skull fracture, Besley (2) found 316 cases with aural bleeding. This is in excess of our findings, but his ratio between left-sided and right-sided involvement compares favorably with ours.

The complications of bloody or cerebrospinal discharge from the ear are otitis media, mastoiditis, and meningitis. In this series there were four cases of meningitis, otitis media occurred nine times, and mastoid infection was present in three cases.

Mastoiditis is a rare complication of skull fracture. While only a limited number of cases have been reported in the literature (see below), probably more would be diagnosed if the possibility of this infection were kept in mind. X-ray examination of the mastoid region is particularly helpful in arriving at a conclusion. It is undoubtedly true that some of the milder cases improve without operative intervention. Because reports of mastoiditis following skull fracture are rare in the literature, the history and the physical findings of our three cases will be given in some detail.

Case 1. Skull fracture following an automobile accident, with bleeding from the right ear, otitis media, and mastoiditis. Operation performed, with recovery.

E. H. (E-5511), age 24 years, was brought to Receiving Hospital in a semicomatose state, exhibiting bleeding from the right ear. Physical examination showed that the pupils, fundi, and extra-ocular movements were normal. There were no cranial nerve palsies. Reflexes were present

throughout. Blood pressure was 130/70. The heart, lungs, and abdomen were negative.

During her stay in the hospital, the right ear drained continuously, and toward the eighth day the discharge became mucopurulent in character. At the same time, the patient developed pain behind the right ear. X-ray examination gave evidence of mastoiditis. After a week of conservative treatment the patient was operated on. A fracture line was found extending across the mastoid region toward the occipital bone, with much purulent material in the mastoid cells. The region was curetted out in the usual manner, the dura and the sinus region being exposed during the operation. The patient made an uneventful recovery.

Comment.—The fracture in this case undoubtedly extended into the middle ear, and extension of the middle ear infection into the mastoid cells was much facilitated by the presence of the bony crack uniting those two spaces.

Case 2. Skull fracture following an automobile accident, with bleeding from the left ear, otitis media, and mastoiditis. Recovery ensued; conservative treatment.

A. H. (E-3479), age 25 years, entered the Receiving Hospital on March 20, 1927, following the accident. On entrance she was in a dazed condition, and was unconscious for about an hour. There was bleeding from the left ear. The neurologic examination was essentially negative, except for the subjective symptoms of headache and drowsiness. During her stay in the hospital, the patient's temperature remained normal, but on March 20 there was much pain in the left ear followed by seropurulent discharge. X-ray examination of the mastoid region two days later showed definite cloudiness on the left side with moderate destruction (second degree) of the air cells. The pain in the ear and the mastoid tenderness subsided, the patient's temperature remaining normal throughout. It was thought advisable to treat her conservatively. She remained in the hospital for 27 days, with complete recovery.

Comment.—Here again we have a patient who developed otitis media following bleeding from the ear. There was definite mastoid tenderness with positive X-ray evidence of mastoiditis; however, it was justly thought advisable to treat her conservatively because the clinical course was one of gradual improvement.

Case 3. Fracture in the mastoid region, following an automobile accident. There was no bleeding from the ear, but simultaneous otitis media, mastoiditis, and meningitis. Mastoidectomy was performed, followed by death.

L. C. (D-13055), age 6 years, entered the Receiving Hospital following an automobile accident. On entrance he was drowsy and had several attacks of projectile vomiting. Physical examination showed an abrasion in the right temporal region; the right pupil was larger than the left, but there was no external evidence of bleeding from the ears. X-ray examination showed a fracture in the mastoid region on the right side, extending toward the lambdoid suture.

During his stay in the hospital the child complained of pain in the right ear; at the same time he exhibited rigidity of the neck. Spinal puncture at first showed clear fluid, but later it was purulent. The right ear drum was incised with escape of mucopurulent material. Mastoidectomy was performed, disclosing this region to be filled with purulent material and showing much destruction of mastoid cells. There was daily drainage of spinal fluid. During the course of events the patient's temperature rose to 105 degrees F. and there was accentuation of the meningeal symptoms, and just before death, which occurred Nov. 19, 1926, the temperature was 109½ degrees rectally.

Comment.—In this case the fracture in the mastoid region was followed by infec-

TABLE I.—ANALYSIS OF 476 CASES OF BLEEDING FROM THE EAR (UNILATERAL, BILATERAL, CEREBROSPINAL LEAKAGE)

Right ear				Left ear				Bilateral bleeding				Complications						X-ray findings							
173 cases				205 cases				98 cases				Meningitis		Otitis media		Mastoiditis		Unilateral Bleeding				Bilateral Bleeding			
																		Positive		Negative		Positive		Negative	
Recovered		Died		Recovered		Died		Recovered		Died		Recovered	Died	Recovered	Died	Recovered	Died	Ex-amined	Not ex-amined	Ex-amined	Not ex-amined	Ex-amined	Not ex-amined	Ex-amined	Not ex-amined
110		63		127		78		32		66		4		9		3		282	97	49		48		1	
	Bleeding		Bleeding		Bleeding		Bleeding		Bleeding		Bleeding														
110	0	62	1	123	4	76	2	30	2	64	2	0	4	8	1	2	1	265	17			48		1	
	Cerebrospinal leakage		Cerebrospinal leakage		Cerebrospinal leakage		Cerebrospinal leakage		Cerebrospinal leakage		Cerebrospinal leakage														
Mortality 37.1 per cent				Mortality 38.5 per cent				Mortality 67.3 per cent																	

tion. The meningitis was most probably secondary to the mastoid infection. Mastoidectomy was performed with a view to removing the focus of infection to the meninges; unfortunately this was of no help to the patient. Although there was no bleeding from the ear, hemorrhage in the middle ear without rupture of the membrane may have occurred.

The X-ray findings in the series are very interesting. In 379 cases with unilateral bleeding, 282 were examined by X-ray. A majority of the patients who were not subjected to X-ray examination either died a short time after admission or were too ill to sustain the added manipulations. A very small number, indeed, were not examined because of transference to another institution. In 98 cases with bilateral bleeding 49 were examined by X-ray. Among those with unilateral discharge 93 per cent gave positive evidence of skull fracture; among those with bilateral bleeding, 98 per cent.

At the Receiving Hospital every case of possible skull fracture is examined by X-ray within 12 hours after admission, with the exception of those who are too ill. Routinely, anterior, one base, and two lateral exposures are made in every case. The base exposure brings out particularly the occipital region and the foramen magnum. Dr. J. C. Kenning, the roentgenologist, insists on as rapid technic as possible, since these patients are in varying degrees of shock, and it is difficult to immobilize their heads for the longer exposure necessary with the Bucky, at least in the majority of the cases. This rapid technic of four views gives very excellent detail of the skull. It is important to focus on the region in which the fracture is suspected, for improper focusing will obliterate fine linear fractures by lapping. All questionable cases of fracture are re-examined, particularly if they show clinical signs of trauma. It is especially advantageous to use the usual mastoid views in some of the

TABLE II.—SITE OF FRACTURE IN RELATION TO BLOODY DISCHARGE FROM THE EAR (313 CASES)

These cases showed X-ray evidence of fracture.

Fracture in the anterior third of the skull			Fracture in the middle third of the skull			Fracture in the posterior third of the skull		
Bleeding right ear	Bleeding left ear	Bilateral bleeding	Bleeding right ear	Bleeding left ear	Bilateral bleeding	Bleeding right ear	Bleeding left ear	Bilateral bleeding
13	18	11	61	83	16	49	56	15

cases in which fractures in this region are suspected.

With such a technic, over 95 per cent of the cases with aural bleeding were proved to have fracture somewhere in the skull; however, it is important to stress that a great many had fractures in distant parts. The most common roentgenologic finding with aural bleeding was a fracture line in the mastoid region extending toward the vertex or the occipital bone, this being true in fully 50 per cent of the cases. A great many had fractures in the parietal bone, extending down into the middle fossa. Others showed fractures in the region of the foramen magnum, probably extending forward toward the petrous bone. A certain number of the frontal sinus fractures exhibited aural bleeding. A few compound and depressed fractures were accompanied by bloody discharge from the ear, but fractures in the mastoid region predominated and constituted fully 50 per cent of the cases.

DISCUSSION

Thus it is seen that bleeding from the ear is a serious manifestation in craniocerebral injuries. The mortality is decidedly higher than the ratio of the total mortality of the entire series, which is around 25 per cent. The cerebral manifestations in cases with aural bleeding are more severe; however, it is surprising to note that a certain number show very little derangement of brain function.

The X-ray findings in the series are commendable. Positive findings in cases with unilateral bleeding were 93 per cent; in bilateral, 98 per cent. It must be emphasized that aural bleeding does not always imply fracture in the region of the ear, at least roentgenologically. A great many in this group suffered fractures in other parts of the skull, and the aural bleeding was most probably merely a complication. *However, it should be remembered that if a blow is severe enough to cause bleeding from the ear, in 93 per cent of the cases a fracture is found somewhere in the skull, with unilateral bleeding.* In cases with bilateral bleeding, there is probably a greater percentage of petrous fractures. The most common roentgenologic finding in this series was a fracture in the mastoid region extending toward the vertex or the occipital bone.

The complications of bleeding from the ear are otitis media, mastoiditis, and meningitis. In the nine cases of middle ear infection seen in this group, the clinical picture presented itself after from a week to ten days. A certain number of these cases recovered with simple drainage. Three had added mastoid infection and one of the latter also developed meningitis. The reason for such a low incidence of otitis media in the

series is explained by the treatment they receive in this Hospital, *i.e., the ear is left alone, no irrigations are used, and the patients are not unnecessarily inspected.* If there is profuse bleeding, the ear is not packed tightly. In craniocerebral injuries, a case of purulent otitis media is a potential case of mastoiditis. The patient's general condition, temperature, appearance of tenderness in the mastoid region are noted and, if necessary, an X-ray film of the mastoid is procured. Middle ear infection is serious, for meningitis may be one of its sequelæ, such as was true in Case 3, the patient also having a purulent mastoiditis. Although the meningeal symptoms were evident, mastoidectomy was performed in order to remove the focus of infection, but, as practically always is the case, this was of no help to the patient.

The incidence of meningitis in the series is 0.85 per cent. Compared with the incidence in the entire group of 2,600 cases, this complication is more frequent in patients with aural bleeding. Meningitis occurred 19 times in the entire group (0.73 per cent). Any operative approach to curb the appearance of this complication in craniocerebral injuries with aural bleeding or cerebrospinal fluid leakage from the ear seems to us rash surgery. A better approach would be medical preventive measures.

Mastoiditis following otitis media, due to aural bleeding in head injuries, has been described by several authors, and in their paper on this subject Miller and Lauppe (3) review the literature. They found 22 reported cases. Their patient showed the clinical evidence of mastoiditis fully three and one-half weeks after the accident. In this paper we have described three cases, one with co-existent meningitis and two uncomplicated cases. The latter two recovered. One was operated on and the other treated conservatively. The patient who died had a mastoidectomy performed, but he succumbed to the complicating meningitis. Although it is a very rare complication in craniocerebral injuries, mastoid infection, particularly in the presence of otitis media, should be kept in mind. We dare say more cases would be diagnosed if this were remembered. The treatment is either conservative or operative, depending on the severity of the clinical manifestations.

A word should be said concerning complicating facial paralysis in cases of aural bleeding. This is not very common, and unfortunately our records on this point are not complete enough to give statistical data. In a more recent series, to be reported later, the incidence of peripheral facial palsy is around 11 per cent. It should be remembered that facial palsy in these patients may not be evident for a day or two, particularly if the patient is very ill. The bilateral difference in the tonicity of the orbicularis oculi, or a slightly open palpebral commissure on the side of the lesion, may give one the clue as to the presence of the condition. Of course, in the co-operative patient the diagnosis is very simple. The facial paralysis is most frequently a unilateral condition, although very rarely one sees a bilateral facial palsy in a case with bloody discharge from both ears, as was the case in one of our recent patients, a boy five years of age. Rarity of bilateral facial paralysis probably is due to the fact that most of the cases with bilateral bleeding die.

In the majority of the examined cases there was a sensory (taste) change in the anterior two-thirds of the tongue on the affected side. This is most probably caused by pressure against, and distortion of, the chorda tympani nerve as it traverses the middle ear. If it were due to a derangement of the geniculate ganglion region, more patients would show dysfunction of the vestibular system, because the vestibular nerve is in close proximity to the facial in this situation. In view of the fact that a majority recover within a few weeks, the pathogenesis is probably hemorrhage about and within

the facial canal, with pressure neuritis ensuing. In a large percentage of the surviving patients there are no associated vestibular signs of dysfunction placing the lesion more peripherally than the internal acoustic meatus.

SUMMARY

Aural bleeding in cases of craniocerebral injury is a serious complication. The treatment is conservative both in cases with bleeding and cerebrospinal fluid discharge. The ear should be left alone if it has stopped bleeding. Unnecessary examination may cause the introduction of infection. In cases in which there is still some discharge, the external ear should be carefully cleansed, the wall of the external auditory canal painted with 4 per cent iodine solution, and a mastoid dressing applied either with no packing of the canal or with very loose packing. As long as the patient does not complain of ear ache and there are no unexplainable clinical manifestations, the less done to the patient, the better the results.

1. A total of 476 cases of aural bleeding or cerebrospinal fluid leakage from the ear are reported.

2. The right ear was involved in 36.5 per cent of the total group; the left ear, in 43.1 per cent; there was bilateral bleeding in 20.6 per cent of the cases.

3. In the group examined by X-ray, positive findings in cases with unilateral bleeding were 93 per cent, and in cases with bilateral bleeding, 98 per cent.

4. Otitis media was found in nine cases, meningitis in four, and mastoiditis in three.

5. The mortality was 37.1 per cent with right-sided, 38.5 per cent with left-sided, and 67.3 per cent with bilateral discharge.

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GASTRIC TUMORS[1]

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APPROXIMATELY 10 per cent of the general run of patients consult a physician on account of gastric symptoms. A study of the causes of gastric complaints in our clinic showed that only 15 per cent of these patients had organic lesions in the stomach or duodenum to account for their symptoms.

Gastric tumors were found in 3.2 per cent of the total series. These tumors consisted of 111 gastric cancers, 3 benign tumors, 1 hair ball, and 2 cases of gastric syphilis, making an incidence of 1 benign gastric tumor to 39 malignant neoplasms. In a study of a large series of gastric tumors, G. B. Eusterman states that in his experience gastric carcinoma is 200 times as frequent as benign tumor.

With the possible exception of the uterus, the stomach is affected by cancer more frequently than any other organ. Notwithstanding the relative frequency and the present accuracy of diagnosis of gastric cancer, this lesion is of such gravity that any series of cases is deserving of detailed study.

In reviewing the histories of a group of patients with gastric cancer, it is immediately apparent that during the past two decades the roentgen ray in the hands of experienced roentgenologists has contributed more to the advancement of the diagnosis of this condition than the combination of all other methods. Yet, owing to the nature of the lesion and the failure to suspect or recognize early signs of the disease, nearly two-thirds of the cases are inoperable at the time the diagnosis is made.

The two chief causes for failure to recognize many early gastric cancers are the anatomic location of the growth and the more or less prevalent idea that the clinical signs of cancer of the stomach always manifest themselves by a sudden onset accompanied by absence of free hydrochloric acid, in a patient previously free of gastric disturbances. The first cause unfortunately cannot be remedied. The second cause can be reduced greatly by reviews of carefully obtained clinical histories of patients suffering from gastric carcinoma.

The location of a gastric cancer has a great deal to do with the early recognition of the growth. A review of our case histories showed that 50 per cent of the lesions began in the pyloric segment, 30 per cent in the middle third of the stomach, and 20 per cent in the upper third. In 80 per cent of the series, the cancer originated in a resectable portion of the stomach. A lesion situated at either orifice produces symptoms indicative of motor disturbances of the stomach much sooner than one located along the greater curvature. Early pyloric obstruction is a fortunate complication because it forces the patient to consult his physician, and vomiting of retained food is a danger sign recognized by even the most inexperienced. The majority of gastric cancers, practically all of which are capable of early demonstration by the roentgenologist, are situated in the pyloric segment or immediately adjacent to it, in an area where they often produce clinical signs, *suggestive*, at least, of the disease. Yet more than half of pyloric carcinomas are inoperable at the time they are diagnosed. Many persons, therefore, are deprived of their only chance of cure or prolongation of life by late diagnosis. Failure to recognize an operable carcinoma is a serious mistake.

[1]Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1–5, 1930.

Carcinomas situated in the upper third of the stomach and not causing symptoms of dysphagia are easily overlooked unless the roentgenologist is constantly on his guard. When clinical signs suggest an intra-

Fig. 1. Case. 1. Artist's drawing showing the findings at the fluoroscopic examination. By palpating the partly filled stomach, three small tumors were clearly seen.

abdominal carcinoma, the necessity of careful examination of this portion of the stomach by the use of special technic and fluoroscopic and radiographic examination in various positions cannot be over-emphasized. Most errors in the roentgenologic diagnosis of gastric carcinoma are made in this region. However, malignant growths of the stomach which are difficult to visualize are as a rule inoperable. A question commonly asked the roentgenologist, after the diagnosis of a malignant tumor of the stomach, is whether or not the case under discussion is operable. Unfortunately there is no method by which the operability of a given case can be determined, owing chiefly to the fact that we cannot tell before operation the presence or extent of intra-abdominal metastasis, either peritoneal or in adjacent organs.

The roentgenologist is of great service to the surgeon in determining the approximate extent of the growth, but there is no definite roentgenologic line of demarcation between the operable and the inoperable case. Surgeons now claim that the surgical accessibility of the growth has a great deal more to do with its removal than the size of the tumor. The general physical condition the habitus of the patient, and the movability of the stomach are very important factors in determining the amount of the stomach which may be resected.

Not infrequently a patient with gastric cancer is deprived of an early diagnosis because the physician he first consults still believes that the gastric disturbances are not due to a cancer because there is a history of chronic dyspepsia and the analysis of gastric secretions shows the presence of free hydrochloric acid. It is a mistake to assume that gastric cancer always begins with a sudden onset in a patient previously free from trouble with the stomach. A patient presenting a history of chronic dyspepsia from any cause may at the moment be developing cancer, and he is just as deserving of a detailed study to determine or to rule out cancer as is one who consults a physician on account of comparatively recent development of gastric symptoms.

Recently[2] we made a study of one hundred cases of cancer of the stomach in which particular attention was paid to the onset and duration of gastric symptoms. The review showed that 62 per cent of the patients gave no history of gastric disturbances prior to the onset of the present complaint, and their increasing gastric symptoms averaged only eight months. Examination of these patients showed a large filling defect on the roentgenogram, and in only two instances was there even a trace of free hydrochloric acid. The smaller group, comprising 38 per cent of the series, presented a striking contrast in having a longer early

[2]M. F. Dwyer, J. M. Blackford, and H. C. Turner: Gastric Cancer. Jour. Am. Med. Assn., Nov. 9, 1929, XCIII, 1456-1459.

Fig. 2. Case 1. Roentgenogram of the partly filled stomach, showing the filling defects produced by the tumors on the posterior wall of the stomach.

Fig. 3. Case 1. Roentgenogram showing the completely filled stomach. Only one small filling defect can now be noted.

history of dyspepsia, averaging ten years before the onset of symptoms characteristic of cancer. These histories of chronic gastric disturbances suggested chronic cholecystitis, gastric ulcer, or the various functional dyspepsias. Gastric analysis was recorded in 31 of the 38 cases, 70 per cent of which showed free hydrochloric acid and occasionally even a hyperacidity. It was of interest to note that in those cases where the original site of the growth could be determined with reasonable accuracy, the group with histories of long-standing dyspepsia were found to have a much larger relative percentage of pyloric cancers than the group presenting short histories. Grave injustice is done a patient if a cancer of the stomach is overlooked simply because he gives a history of chronic indigestion, and free acid can be demonstrated in his gastric contents.

Benign tumors of the stomach are not common. In over five thousand examinations in our clinic, three cases of benign tumors and one gastric hair ball were encountered. While they are not of frequent occurrence, these benign neoplasms are of sufficient importance that the possibility of their presence must continually be borne in mind by both clinician and roentgenologist. A benign gastric tumor may be the cause of atypical gastro-intestinal complaint, and its finding and successful removal by an exploratory operation will recompense and justify a very grave pre-operative diagnosis of malignant disease.

The three cases of benign tumors here reported consist of: one with five very vascular mucous polyps, one large fibromyoma, and one leiomyoma.

In reviewing these cases, one is impressed by the lack of gastric symptoms. With the

exception of repeated gastric hemorrhages in the case of the leiomyoma, there were no symptoms indicative of gastric diseases. Gastro-intestinal hemorrhage appears to be a relatively frequent finding in this class of case; however, the number of cases reported in the literature is too small to justify one in drawing conclusions as to the characteristic symptomatology of benign gastric tumors.

Briefly, benign tumors are classified as papillomas, myomas, adenomas, fibromas, lipomas, osteomas, cysts, and adenopapillomas, the presence of the last being commonly called polyposis.

CASE REPORTS

Case 1. A clergyman, aged 48, consulted us in July, 1927, complaining of repeated severe attacks of diarrhea over a period of twenty-five years. In 1903, the patient had had an attack of indefinite upper abdominal distress, associated with jaundice and fifteen or twenty bowel movements a day. The diarrhea was not painful and no blood was seen, but a considerable amount of mucus was passed. In 1924, the gall bladder was removed, and the patient states that, after this operation, his diarrhea was less until three months before consulting us. In 1926, he weighed 175 pounds. In May, 1927, another attack of diarrhea began. He was examined clinically and roentgenologically by his family physician, who found no trouble in his stomach. The diarrhea continued, and he then came to Seattle. On arriving at the Clinic, his condition was so critical that he was immediately placed in the hospital. He had lost 50 pounds in weight and was very emaciated. Laboratory examinations showed a marked secondary anemia, a hemoglobin of 65 per cent, and absence of free hydrochloric acid. Roentgenologic examination showed three small tumors in the upper third of the stomach posteriorly (Figs. 1, 2, 3), and a diagnosis of benign tumors was made. Examination of the colon was negative. The patient was operated upon July 30, 1927. The stomach was opened by a midline incision and five polyps removed (Fig. 4). Three of these had been detected on X-ray examination, one polyp about the size of a lemon and two about the size of a cherry. Each of the additional two found at operation was about the size of a cherry seed.

Pathologic examination showed each tumor to be a highly vascular mucous polyp, covered by a single layer of gastric mucosa. The underlying tissue was mucoid in character, similar to that seen in a nasal polyp.

This patient, whose progress has been closely followed, was last seen one month before the present report. He has been free from diarrhea since operation, a period of 40 months, has gained 45 pounds in weight, and states that he feels perfectly well.

Case 2. An Alaskan miner, aged 67, consulted a physician in October, 1926, on account of loss of 60 pounds in weight, weakness in his legs, and two severe attacks of diarrhea. A considerable amount of blood was passed during the second attack of diarrhea. During the attacks, he occasionally felt nauseated and vomited a few times. He stated that, with the exception of chronic constipation, he had always enjoyed good health prior to the onset of his present complaint. On examination of his blood, erythrocytes 3,130,000, leukocytes 14,000, and hemoglobin, 48 per cent were reported. Physical examination showed a markedly emaciated man, with a palpable epigastric mass the size of an orange. Roentgenologic examination showed a large filling defect on the mid-posterior wall of the stomach, which was thought to be cancer. An exploratory examination was advised.

On opening the stomach, a large pedunculated tumor (Fig. 5) about the size of an orange was found attached to the posterior

wall. Its surface was markedly irregular and of a cauliflower appearance. Pathologic examination showed the mass to be a fibromyoma (Fig. 6) with marked inflammatory changes.

tric hemorrhage. She was placed in a hospital, and two transfusions were given. Gastric acidity was normal. The roentgenologic examination, done elsewhere, was said to be negative. Twenty days after the

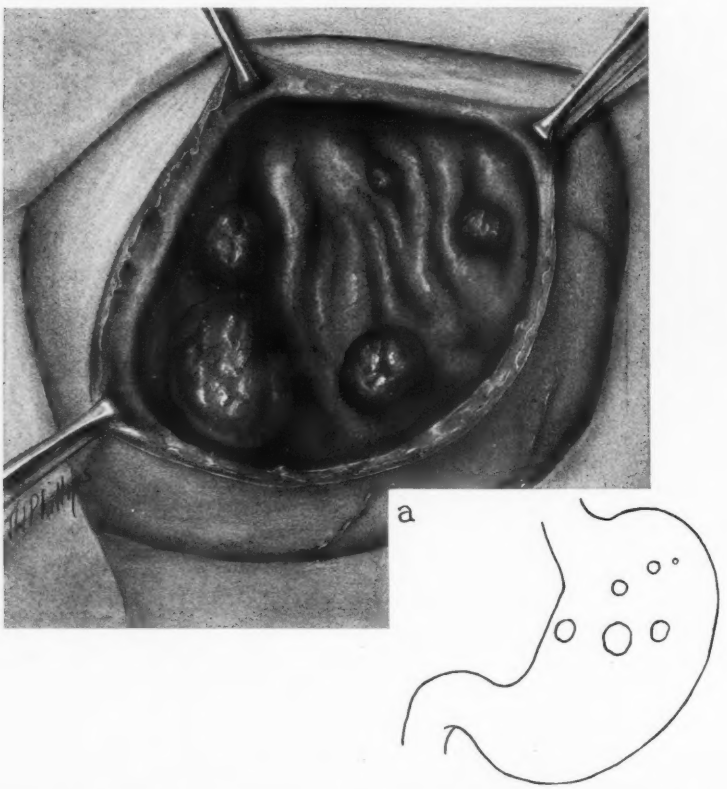

Fig. 4. Case 1. Drawing showing relative positions of the tumors as shown by fluoroscopic examination and the position and relative sizes of the tumors as found at operation.

The patient made an uneventful recovery and returned to Alaska, where he died a year and a half later. According to meager reports obtained from his friends, his stomach was apparently not the cause of his death.

Case 3. A woman, 35 years old, consulted a physician on account of severe gas-

first hemorrhage, another gastric hemorrhage occurred. Sixteen transfusions were given in an effort to get her in condition for operation. A tumor mass was palpated in the upper left quadrant of the abdomen, and, because of the negative roentgenologic findings, the mass was thought to be splenic. Operation was advised. A pedunculated

tumor about the size of a grapefruit was found attached to the posterior wall by a small pedicle. Histologic examination of the tumor showed it to be a leiomyoma.

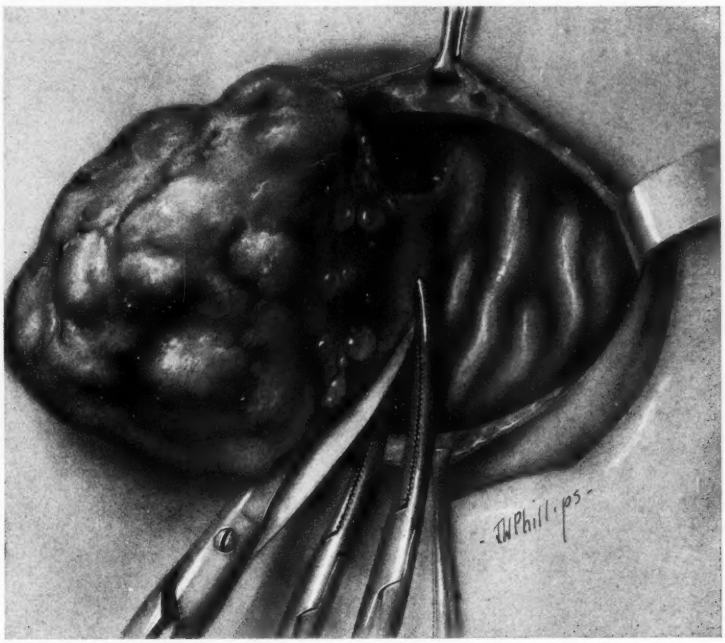

Fig. 5. Case 2. Drawing showing the surgical removal of the pedunculated fibromyoma.

This patient has been free from symptoms for 9 years.

In reviewing these cases, it is readily apparent that the roentgenologic examination was the most important factor in the diagnosis. The clinical signs were very indefinite, and, with the exception of one case presenting severe gastric hemorrhage, there were no symptoms indicative of gastric pathology. All the patients complained of anemia and loss of weight. Two complained of diarrhea, and, in the case with the polyps, severe diarrhea was the sole complaint.

All these tumors were located on the posterior wall. The value of the careful palpation of a partially filled stomach during fluoroscopy cannot be emphasized too strongly. If we had not made this method of examination a routine procedure, the small tumors on the posterior wall would have remained undiagnosed.

One must never be hasty in making a diagnosis of inoperable carcinoma. An extensive filling defect seen on a roentgenogram, accompanied by a large palpable epigastric mass, is not always a sign of inoperability. Practically every patient is entitled to an exploratory operation. If for various reasons the mass is not suitable for resection, many will be benefited by an operation for relief of obstruction.

Careful roentgenologic examination of

the stomach accompanied by surgical exploration will go a long way to increasing the number of benign gastric tumors. An early diagnosis is of great benefit to the patient, as a carcinoma may develop on a benign tumor, especially the multiple polypoid variety.

Fig. 6. Case 2. Cross-section of the fibromyoma.

A gastric hair ball is a very infrequent cause of a palpable epigastric mass. The case here reported is a large hair ball forming a complete cast of the stomach in a girl 8 years of age.

This child was referred to us 10 years ago on account of a freely movable abdominal tumor. There were no digestive disturbances, the mass was painless and not tender to palpation, the appetite was fair, and there was no loss in weight. Examination of the blood showed hemoglobin 62 per cent, erythrocytes 4,120,000, leukocytes 11,400. The child had acquired the habit of chewing the ends of her curls. Examination of the head showed the hair over the frontal region to be much thinner than elsewhere. From the history of long continued hair chewing and a movable mass in the epigastrium, a clinical diagnosis of gastric hair ball was made.

Roentgenologic examination showed the barium mixture to penetrate slowly between the wall of the stomach and the hair ball. As the patient continued to drink the mixture, the entire gastric contour was visualized, but the area outlined by the hair ball was faintly shadowed.

The patient was operated upon and a hair mass forming a complete cast of the stomach was removed. At a recent interview, it was found that she has had no after-effects following the experience of hair-eating ten years ago.

SUMMARY

1. The roentgenologist seldom fails to diagnose a gastric cancer, yet, owing to the location of the growth and the failure to recognize early signs of the lesion, the majority of gastric cancers are far advanced at the time of diagnosis.

2. A patient who gives a history of chronic dyspepsia and whose gastric secretions show the presence of free hydrochloric acid may have a cancer of the stomach. This patient is just as deserving of a detailed study to determine or to rule out cancer as is one who consults a physician on account of comparatively recent development of gastric symptoms.

3. In our series of patients with gastric carcinoma 38 per cent give a history of dyspepsia averaging 10 years before the onset of symptoms characteristic of cancer. Seventy per cent of these patients had free hydrochloric acid in their gastric contents.

4. A benign tumor of the stomach, although rare, may be the cause of an atypical gastro-intestinal complaint. Two of the cases here reported complained of no clinical symptoms suggesting a lesion of the stomach. All complained of anemia, loss of weight, and weakness. Persistent diarrhea was practically the sole complaint in one case.

5. The value of careful palpation of the partially filled stomach during fluoroscopy cannot be emphasized too strongly. If this method of examining the posterior wall of

the stomach had not been used routinely, the case with the polyps would not have been diagnosed.

6. To quote J. C. Bloodgood: "Do not diagnose inoperable carcinoma from palpation and X-ray alone. Give the patient the benefit of exploration unless there are skin metastases or fluid in the peritoneal cavity. Even then, if there is obstruction, operation is indicated."

REVERSE BLOOD FLOW IN HANDS AND FEET TO RELIEVE GANGRENE

An unusual case in which the flow of blood in a patient's hands and feet has been reversed for twenty years has just been reported to the American Medical Association by Dr. Bertram M. Bernheim of Baltimore.

The operation was performed to relieve gangrene which developed as a result of Raynaud's disease, an ailment affecting the smallest arteries and veins. When circulation in these is affected, as in Raynaud's disease, the tissues supplied by them do not get proper nourishment, and die.

To correct this condition, Dr. Bernheim performed an operation linking an artery to a vein in the patient's left leg. The blood, which could not get down the diseased artery to the left foot and toes, was able to flow down the vein to the foot. Normally, of course, blood flows out from the heart in the arteries and back through the veins. This reversal of blood flow was successful in relieving the gangrene and pain of Raynaud's disease in the left foot. Later, when the other foot was attacked, and still later when the disease began to affect the hands, operations were performed to reverse the circulation in these members.

The patient, who was 26 years old at the time of the first operation, is now about 45 and in excellent health generally, Dr. Bernheim found on examination nearly twenty years after her last operation. However, pain has returned and gangrene set in again in the remaining toes of the feet and in one finger. The reason for this cannot be determined, nor can the final outcome of the case be predicted, Dr. Bernheim stated. The openings from arteries to veins in the arms appear still to exist and have probably prolonged the patient's life and health for many years.

DIVERTICULOSIS OF THE COLON[1]

By FRANZ M. GROEDEL, M.D., Bad Nauheim, Germany

DIVERTICULA are small pulsion pouches or hernia of the mucosa or sub-mucosa (diverticula spuria), or more rarely pulsion pouches of all layers of the abdominal wall of the colon (diverticula vera). Diverticulosis is more common in men than in women. The diverticula are generally situated near the edge of the mesentery. These pockets almost always occur in the sigmoid flexure, more rarely in the rectum. They have been thought to be related to constipation and fecal stasis, so common are they at these points. They can exist for a long time without giving rise to symptoms; but here, as in the vermiform appendix, retention can lead to suppuration and perforation. Aschoff distinguishes two forms: (1) Congenital, and (2) acquired, or true and false diverticula. Aschoff (1) also finds that the sigmoid flexure is the most common site.

The diagnosis of diverticulosis is made by X-ray examination. Not much has been heard from radiologists in the literature of Germany (2) about diverticulosis, although most of us have come across this peculiar condition of the bowels.

The following clinical notes may be of interest. A 71-year-old man had been a patient of mine for two years. He had never had any serious illness, but had complained of flatulence and abdominal pain and discomfort off and on for four years, accompanied by loss of weight. On X-ray examination and test meal three years ago, the only findings were abnormally increased stomach motility and achylia. At the time, this condition was considered to be due to pyorrhea, from which he was found to be suffering. In spite of dieting and treatment, loose stools and attacks of diarrhea soon after meals persisted.

On X-ray examination the following points were noted:

1. Immediately after the barium meal the stomach was completely pressed up against and adherent to the liver. Neither the pylorus nor the duodenum was visible. A few coils of intestine were overfilled and bulging.

2. One and a quarter hours after the meal the stomach was empty but still adherent to the liver. Behind it a fairly normal bulbus was seen. The upper coils of intestine were considerably dilated. The bulk of the barium meal was in the small intestine.

3. Three and a half hours after the meal the cecum and ascending colon were filled. The small intestine was very irregularly filled. Bubbles of air indicated the shadow of the transverse colon, which was displaced upwards.

4. Eight hours after the meal the small intestine was quite empty. The barium mass was collected in the rectum. The cecum was still full of air and the appendix was filled. The only signs of the transverse colon and the colon descendens were round bubbles of air and round spots of shadow. Round pulsion pouches the size of coffee beans were seen in the S romanum.

5. Twenty-five hours after the meal the whole large intestine was visible and contrasting shadows showed its whole course, the ingested food, and the much thinned and retained contents. Numerous pockets were seen over these thin shadows, just at those points which were filled with the barium porridge twelve hours before. The appendix was not quite empty.

6. Thirty-five hours after the meal the appendix was still filled, although complete

[1]Read before the Radiological Society of North America at the Thirteenth Annual Meeting, at New Orleans, La., Nov. 28–Dec. 2, 1927.

evacuation of the bowels had occurred. Near the appendix, two large pockets in the right flexure, six diverticula in the transverse colon, and seven in the colon descendens were seen. In the flexure of the S romanum, one large pocket was seen and numerous diverticula in the S romanum.

Diagnosis.—Extensive perigastric adhesions of the pylorus region, probably from some cholecystitic process, and diverticulosis of the whole colon (diverticula vera).

Shortly after the diagnosis was made, the patient was taken ill with symptoms resembling those he had once previously had, *i.e.*, pain in the region of the sigmoid flexure with temperature. There was considerable tenderness to pressure on this region, and over the course of the whole colon. It was evidently an acute attack of diverticulitis, very similar to an acute appendicitis.

Noteworthy in this case are the extensive distribution of diverticula over the whole colon, the large size of the several diverticula, and the very long persistence of the diverticular shadows.

In his monograph, Strauss (3) maintains that the diverticula of the large intestine can be distinguished only by X-rays, with the aid of rectal enemas as the only fluid matter that can enter the diverticula. According to De Quervain they are best seen when a part of the enema has left the rectum.

In all cases, Strauss is of the opinion that extreme care and careful criticism should precede diagnosis.

Because in the case cited there was little or no difficulty in demonstrating the condition, we are of the opinion that it is only the diverticula spuria that cause any difficulty of demonstration; and we believe that the rarer and more important diverticula vera can be demonstrated with perfect ease and certainty by the improved technic of to-day.

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TUMORS OF THE MALE BREAST, BASED ON A STUDY OF THIRTY-ONE CASES

By BERNARD F. SCHREINER, M.D., F.A.C.S.

State Institute for the Study of Malignant Disease, BUFFALO, N. Y.
Burton T. Simpson, M.D., Director

DURING the years 1914 to 1931 (June), there were 17,486 cases admitted to our tumor clinic for examination and treatment. Included in this number were 1,664 diseases of the breast submitted for study, treatment, and observation. Only 31 of these breast lesions were in males. For this reason, it was thought of sufficient interest to tabulate and record the pathologic conditions for which advice was sought.

The following is a comparative table:

PATHOLOGIC CONDITION	MALES	FEMALES
Malignant Lesions:		
Carcinoma	15	1,240
Epithelioma skin		
Pearl cell	....	1
Basal cell	....	1
Paget's disease	....	14
Sarcoma	1	4
Benign Lesions:		
Chronic mastitis	4	125
Cystic mastitis	4	108
Cystic adenoma	....	17
Papillary cysts	....	13
Polypoid cyst	....	1
Sebaceous cysts	1	2
Adenoma	....	5
Fibro-adenoma	1	62
Myxofibro-adenoma	....	1
Fibro-angioma	....	1
Papilloma nipple	....	5
Fibropapilloma	1	1
Lymphangioma	1	....
Lipoma	1	6
Tuberculosis	1	6
Nevus	....	3
Supernumerary nipple	....	2
Eczema	....	3
Hypertrophy	....	1
Inflammatory lesion and abscess	1	11
	31	1,633

In a recent paper, Neal and Simpson (1) brought to our attention the various diseases of the male breast that were encountered in 5,000 cases. In 1927, Wainwright (2) made an exhaustive study of the literature, both historical and recent, of carcinoma of the male breast. He then analyzed a large number of the cases reported and summarized his findings. It is apparent, from the relatively small number of cases reported, that carcinoma in the male breast is less frequent than in the female breast.

Various observers from time to time have given the impression that carcinoma of the male breast was not so malignant as carcinoma of the female breast. This apparently is an erroneous idea as is shown by subsequent observations of the cases which Wainwright has studied and from observations of our own 15 cases.

Ewing (3), in his book on Neoplastic Diseases, states that the frequency of cancer of the male breast is from 0.8 per cent to 6.0 per cent of all breast cancer, quoting Williams and LaForgue as authority. Deaver and McFarland (4) in their series estimate that 1.5 per cent of the malignant breast tumors and 2 per cent of the benign tumors occurred in men; and that 80 per cent of the tumors of the male breast are malignant. Our statistics show that 1.25 per cent of all the breast cancers admitted were in the male, and that 50.1 per cent of all male tumors were malignant.

Chronic inflammatory lesions often precede the development of malignancy and it is for this reason that benign lesions in the male breast were treated rather radically by amputation of the breast.

Of our 31 cases of tumors of the male breast, 15 were benign and 16 malignant. Among the 16 malignancies, one was a spindle-cell sarcoma. This man, who was 77 years old, gave a history of soreness, drawing sensation, and a small hard lump for eighteen months prior to admission to the clinic. At the time of examination, he

had metastases in the axilla. The tumor was removed surgically and then treated with high voltage X-ray. He died from recurrence and old age four months later.

The age incidence of the 15 cases diagnosed as carcinoma is shown in the following table:

30-39	40-49	50-59	60-69	70-79	80-89
2	2	5	1	4	1

The youngest was 33 and the oldest 89; 11 occurred after the age of 50.

The history of duration of the lump varied from 1 month to 20 years as shown below:

Less than 6 months	3
6 months to 1 year	3
1 to 2 years	3
2 years	1
3 years	2
Over 4 years	1
Twenty years	2

Wainwright, in his study, also reports several cases with a history of 20-year duration of the lump before treatment.

Biopsy or section was obtained in 12 cases; of these 11 showed scirrhous carcinoma, and one, adenocarcinoma. In the other cases, the lesions were so far advanced that a definite clinical diagnosis could be made without section.

Upon examination, four cases were found to be ulcerating; of these, three were in far advanced stages, and one, in a patient in an early stage in whom only the breast was involved. There were three other cases in which the tumor was confined to the breast and no nodes were palpable, three cases in which only axillary nodes were palpable in addition to the breast tumor, and five other cases in which there were widespread metastases. Four cases were post-operative, recurrent, with widespread metastases. Definite mediastinal involvement was shown in four cases; definite skin metastases, in three cases, and general carcinomatosis, in one case.

Fig. 1. Carcinoma of the breast with aleukemic leukemia, at time of admission to the Institute.

Fig. 2. The same patient, one year after operation and treatment.

TREATMENT

Three cases (admitted between 1915 and 1920) were treated with low voltage filtered X-ray with unfiltered X-ray over the ulcer; two had high voltage X-ray only; seven had removal of the tumor surgically, followed by high voltage X-ray, and one had high voltage X-ray, radium pack, and implantation of radon seeds in the breast. Two were not treated: one of these had amputation elsewhere but the result of this operation is not known as he did not return to the Institute.

Three of those treated surgically had amputation before admission; they were re-

current, far advanced, when admitted. Two died in less than a year and one, somewhere between one and two years.

Three cases in which surgery was done at the Institute, no nodes being present at the time of operation, have been well four years, one year, and two months, respectively, or since the time of operation.

In one of the cases treated surgically, there were metastatic nodes in the axilla at the time of operation. This patient has been well since treatment—two years, seven months.

Of those treated by irradiation alone, none was an early case and all but one are dead. This one has been treated for two years and five months. There has been no progression of the disease. The patient refuses amputation though he has been urged several times to submit to it. The others died: four in less than a year, and one between two and three years.

Of these 15 cases, only eight are available for 5-year study. Only one had no lymphatic or other involvement. This patient has been well for four years. He did not submit to amputation until two years after admission; during this time he had high voltage X-ray. Section at the time of operation showed carcinoma. The other patients have all died.

Two of the cases of carcinoma of the breast had complications. One patient (Fig. 1) had large lymph nodes in the axilla, which, at the time of operation, were found to be hyperplastic. Subsequently, the patient developed nodes in the neck. The blood findings, 16,800 leukocytes with 75 per cent lymphocytes, confirmed the diagnosis of aleukemic leukemia. One, who on section showed adenocarcinoma of the nipple, had had an epithelioma of the penis which had been well for six and one-half years, and an epithelioma of the left corner of the mouth, which had been well for two years.

CONCLUSIONS

1. Carcinoma of the male breast is about 1.25 per cent of all cancers of the breast in our series.

2. Carcinoma of the male breast is an uncommon disease; sarcoma is rare.

3. Carcinoma of the male breast is as malignant as carcinoma of the female breast.

4. This disease occurs, as a rule, late in life.

5. With few exceptions, patients in our series applied for treatment late in the course of the disease.

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THE CONCEPT OF DOSAGE AND THE DEFINITION OF THE r-UNIT (ROENTGEN UNIT)

By DR. RICHARD GLOCKER, Professor fur Röntgentechnik und Vorständ des Röntgenlaboratorium an der Technische Hochschüle, STUTTGART, GERMANY

Translation by GEORGE L. CLARK, PH.D., Department of Chemistry, University of Illinois, Urbana

THE two attributes for characterizing and measuring an electromagnetic ray (light, X-rays, γ-rays) are the wave length and the intensity. Two rays with equal wave length are qualitatively equal; they possess, for example, equal penetration power. The measurement of wave lengths is made by the spectrographic method. The radiation intensity is a measure of quantity; it corresponds to what is ordinarily termed quantity of radiation. In the newer definition, the radiation intensity is that radiation energy which strikes in one second upon a surface of 1 sq. cm. perpendicular to the direction of the ray. An absolute measurement of intensity for X-rays is very difficult and depends upon the very minute increase in temperature resulting from the complete absorption of the rays in any irradiated object. For all other effects of X-rays (ionization, photographic plate, fluorescent screen, selenium cell, skin erythema, etc.), the degree of action depends on the radiation intensity and also on the wave length. On this account a different fraction of the initial radiation intensity for different wave lengths is transformed in the irradiated medium into other energy forms. The action is, therefore, independent of the wave length only when the beam of given initial intensity inclusive of the secondary rays arising therefrom is completely absorbed in the irradiated material—a condition which can be realized practically only with methods based on the thermal effect. How great can be the difference in the dependence of the sensitiveness of different methods of measurement upon the wave length is demonstrated in Figures 1 and 2.

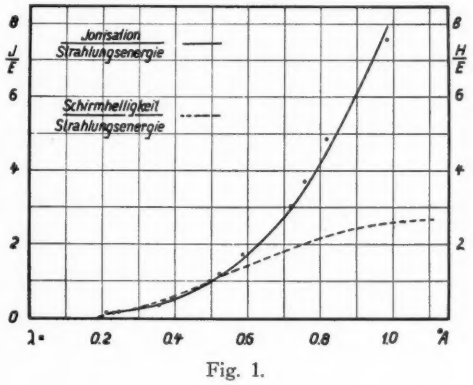

Fig. 1.

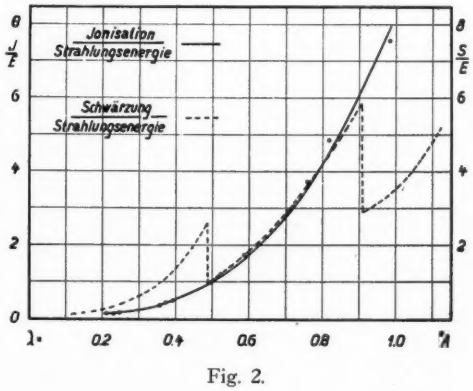

Fig. 2.

If different homogeneous rays, *i.e.*, rays which possess only a single wave length, fall simultaneously with equal intensity upon an air ionization chamber, a fluorescent screen, and photographic plate, the brightness of the screen changes much less with wave length than the ionization current (1). Upon comparison of the ionization and blackening of the photographic plate, it is especially noteworthy that the photographic sensitive-

ness changes with sudden jumps in two places (0.49 and 0.91 Ångström unit). Since these wave lengths coincide with the discontinuities in absorption coefficients of silver and bromine, the two effective constituents of the photographic emulsion, it must be concluded that the photographic action is closely connected with absorption. Not only for the photographic effect but also in other cases, for example ionization, the following principle holds: the action of rays changes with wave length in the same way as the intensity of the absorbed portion of the incident rays changes. Exceptions occur in the region of very short wave X-rays, when the Compton effect is appreciable, and in the case of the excitation of characteristic fluorescent rays of the irradiated material. A very recent investigation has now demonstrated that all known physical and chemical effects (2) are governed by a simple law, the law of electron transfer. The effect changes with the wave length in the same way as the fractions of the incident radiation energy transformed into the energy of photo- and Compton electrons. This value may be calculated for certain chemical compositions of a material from physical data (absorption coefficient, recoil coefficients, etc.). The good agreement between theory and experiment is shown in Figure 1 for the case of ionization, the circles corresponding to experimental values, the curve itself being theoretically calculated. The earlier mentioned law of proportionality of the effect in the absorption constitutes a special case of the general law of electron transfer: if no characteristic radiation is generated, the whole absorbed energy is transformed into the energy of photo-electrons and both magnitudes change in the same way with wave length; further, if the radiation is not of such short wave length that Compton electrons with appreciable energy appear, the chemical or physical effect coincides with the energy of the photo-electrons alone.

The knowledge of the fundamental laws of physical and chemical radiation effects is of important use for a discussion of the dosage problem. The idea of dosage arose from the immediately practical necessity to provide for therapeutic irradiation a physical measurement determined independently of the wave length of the rays for the intensity of the biologic reactions, especially for the skin erythema. Since the primary process of a biologic effect is a physical-chemical one, it is to be expected that equal intensities of two qualitatively different X-rays would possess different biologic effectiveness. Apart from the already mentioned difficulties of an absolute intensity measurement, such a method would also constitute an entirely impracticable dosage measurement for therapy, since the biologic action changes from wave length to wave length even for conditions of equal incident intensity. The aim of practical dosage measurement must, therefore, consist in the selection of a radiation effect as the basis for dosage measurement which changes with the wave length in the same way as a given biologic reaction, for example, the production of skin erythema. The measurement of the ionization current in air under conditions in which the wall effect is eliminated has served in this respect empirically as the most important method of dosage measurement apart from very soft rays (Bucky's Grenz rays) for which the inhomogeneity of absorption for different parts of the skin plays an important part, a complete parallelism between skin erythema and air ionization existing independent of the quality of the radiation (3).

The conception of dose was first formulated exactly by Christen (4) in the year 1913. *The physical dose is the radiation energy absorbed in a volume element of a body during the time of irradiation divided by the magnitude of the volume element.* Since the radiation energy falling upon the

different deep lying points of a body is greatly different, it is essential to proceed to the definite establishment of such a small zone of the irradiated body that within this zone an average constant radiation energy can be calculated with sufficient accuracy. In this case instead of the exact expression for the radiation intensity absorbed in the thickness "D" for an X-ray beam with absorption coefficient

$$(1) \quad I_1 - I_2 = I_1 \ (1\text{-}e^{-\bar{\mu} D})$$

it is permissible to make the approximation (expansion of the exponential function to a series)

$$(2) \ I_1 - I_2 = \bar{\mu} D$$

The total absorption radiation energy in a cubic volume element with the surface "Q" and the height "D" in the exposure time "t" is then

$$(3) \quad \bar{\mu} D Q I_1 t$$

After division by the size of the volume element "Q D" there is obtained by definition the dose "X." It is, therefore,

$$(4) \quad X = \bar{\mu} I_1 t$$

In other words the dose "X" is equal to the product of the absorption coefficient, the intensity of the incident ray, and the exposure time.

Against the dose idea of Christen it may be objected that it is practically unusable since one is ordinarily not in the position to measure the intensity I_1 by simple technical methods. Nevertheless this idea has been of greatest usefulness for dosimetry. It contains an expression at that time by no means experimentally capable of verification accounting for how the biologic action changes with radiation quality. It gives, therefore, a lead for finding out a physical effect which is characterized by the same dependence upon wave lengths as skin erythema.

It is evidently necessary to find the effect upon a material which corresponds in its absorption properties to tissues or water. Since the absorption coefficient depends not only upon the wave length but also upon the density and the atomic number of the elements constituting a material, it is to be expected that the air, consisting of the light elements, oxygen and nitrogen, should possess the same absorption properties as the tissues, consisting of organic compounds of carbon, nitrogen, and oxygen.

Experimental researches have fully substantiated this expectation. At the second International Congress of Radiology in 1928, as an outgrowth of the work of Szilard, Friedrich, Behnken, and others, the measurement of air ionization was accepted as the basis of international dosage measurement and a definition was given of the unit of dosage designating a roentgen unit and written in abbreviated form as "r." *The absolute unit of X-ray dosage is derived from that X-ray energy which, by the irradiation of 1 cubic centimeter of air at 0° centigrade and 760 millimeters mercury pressure, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.* How does this definition of dose compare with that of Christen? If an exception is made, first, of the short wave length region on account of Compton scattering, it is true as was explained in the introduction that the air ionization is proportional to the radiation intensity absorbed in the volume unit of air. The product of the ionization current and the time of irradiation (5) is, therefore, a measure for the dose in air in the sense of Christen's definition. Since the dependence upon wave length of the absorption coefficients of light atomic substances is the same, the dose in air is proportional to the dose in the tissue. It follows that the roentgen unit, aside from a practically negligible proportionality constant (6), measures the

physical dose in the tissue as was first defined by Christen.

The observation found in the literature that the introduction of the roentgen unit involved the proposal of the original definition of the conception of dose is, therefore, an error. The knowledge of the fundamental laws of physical and chemical action of X-rays leads to the possibility of so extending the idea of dose that it will apply for all X-ray wave lengths. As was indicated in the introduction, the proportionality of the effect to the absorbed radiation energy is only a special case under certain assumptions of the general law that the electron transfer (total kinetic energy of the liberated photo- and Compton electrons) is determinative for the physical and chemical effects and their changes with wave lengths. Upon analogous grounds, the same thing would be expected for the biologic action. Against the conception that X-rays act upon the cells in such a way that, first, electrons are liberated from the irradiated atoms, and, then, the action of these electrons gives rise to the initiation of cell destruction, have appeared researches of Politzer and Pauli (7) in which it has been discovered that in the irradiation with cathode rays of salamander larvæ a kind of nuclear pectosis (stainability of spindle fibers) was found which was never observed in irradiation with X-rays. It must be concluded from this that the action of electrons and of X-rays is of a different type. More recently (8), however, it has developed that it is possible to obtain the same effects also with X-rays provided that extremely large dosages, several hundred thousand r in a few minutes, are applied in short time. Thus this experimental exception refutes the earlier conclusion.

When it is borne in mind that the definition of the roentgen unit is derived from ionization in air and that the validity of the proportionality of the effect with the electron transfer has been experimentally proved (Fig. 1), it is possible in two different ways to proceed to the following generalization of the Christen definition of dose. *The physical dose is the electron energy (kinetic energy of photo- and Compton electrons) liberated by the action of X-rays in a volume element of the irradiated body during the time of exposure divided by the size of the volume element.* In equation 4 above in place of absorption coefficient $\bar{\mu}$ is substituted the expression $\propto\bar{\mu} + \sigma_r$ in which $\propto$ means the fraction of the absorbed energy which is changed into the energy of the photo-electrons. In the region of the ordinary therapeutic X-rays, $\propto$ is made equal to one on account of the absence of the characteristic radiation in biologic objects. The recoil coefficient σ_r is an expression for how much of the X-ray energy scattered in the Compton effect is transformed into the energy of Compton electrons. For the wave length region ordinarily utilized in therapy, the dose and the unit of dose are clearly established. In going over to the extremely long wave X-rays, 4 Å.U. and more, however, the following difficulty arises out of the definition of the roentgen unit upon the basis of air ionization: the absorption edge of argon at 3.86 Å.U. results in the absorption in air changing discontinuously at this wave length, whereas the same phenomenon does not take place in tissues or water. The dose in air and the dose in the tissue are, therefore, no longer proportional to each other. The magnitude of the argon discontinuity can be determined with the help of new gas absorption measurements of Wörnle (9). The chemical composition of air in weight per cent according to Ramsay (10) is as follows:

O_2	N_2	Ar	Kr	X	Ne	He	CO_2
23.2	75.5	1.3	0.028	0.005	0.00086	0.000056	0.046

Among the rare gases only argon has an appreciable effect upon the absorption. The ratio of the mass absorption coefficients of

air containing argon, and argon-free air has the value 1:0.88 for wave lengths shorter than 3.86 Å.U. and 1:1 for wave lengths longer than 3.86 Ångström units. Since, according to Gärtner (11), the work of ionization in argon is about 19 per cent smaller than in air, the contribution of the argon atoms to total ionization is greater than corresponds to their portion of the absorbed energy. For long wave rays above 3.86 Å.U., ionization in argon-containing and in argon-free air is equal, while below the argon absorption edge the ionization in argon-free air is only 0.84 as great as in ordinary air. Now since biologic objects in general contain no higher atomic elements in such concentrations (12) that their absorption edges are appreciable in comparison with the total absorption, this result means that for wave lengths less than 3.86 Ångström units, for dosage measurement in r units, the dose in biologic objects is about 18 per cent greater than the number of r units indicates. The dose so measured is too small. Taking into consideration the effect of the krypton absorption edge, this number is increased about 2 per cent more (13). Although at the moment the question of the extension of the definition of the roentgen unit for the extreme wave length region has no very important meaning for therapy, a consideration of the increasing application of long-wave rays in biologic researches (Lacassagne and Holweck, 14, Wyckoff, 15) will very soon necessitate a final and definite solution to the problem. On this account it must, therefore, be established that magnitude of the dose will not change for all therapeutically used X-ray wave lengths. For the definition of the r unit, all gases can be utilized which in the long wave length region are free from absorption edges, for example, a nitrogen-oxygen mixture of 23.5 weight per cent O_2 and 76.5 weight per cent of N_2; or carbon dioxide. Carbon dioxide is proposed upon the grounds of practical simplicity. A new wording of the definition of the roentgen unit would, therefore, run somewhat as follows: *The absolute unit of the X-ray dose is derived from the fraction X of that X-ray energy which, when the secondary electrons formed in the gas are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimeter of carbon dioxide gas at 0° centigrade and 760 millimeters mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.* The magnitude "X" can be determined by simple comparative measurements once for all cases with an ionization chamber filled with air and with carbon dioxide. Since the effective atomic numbers of both gases are approximately equal, "X" must correspond approximately to the ratio of densities, namely, the number 0.66. With this new wording, a real proportionality between dose in standard gas and dose in biologic object should exist. This substantiates the possibility of undertaking all practical dosage measurements for therapeutic irradiation with air ionization chambers.

SUMMARY

1. It is shown that the formulation of the idea of dose given by Christen and the definition of the roentgen unit agree with one another.

2. An expanded definition growing out of the fundamental laws of physical and chemical effects of X-rays is given for the concept of dose.

3. For support of the proportionality of the dose in the biologic object and the dose in the standard gas, even upon the long wave length size of the argon absorption edge, a new wording of the definition of roentgen unit is proposed.

REFERENCES

(1) GLOCKER, R.: Ztschr. Physik, 1927, XLIII, 827; 1928, XLVI, 761. The curves refer to the wave length 0.5 Ångström unit.

(2) Reactions are excluded in which the primary process is concealed by secondary reactions, for example, decomposition of iodoform in chloroform.

(3) (a) HOLTHUSEN, HANS: Strahlentherapie, 1927, XXVI, 472.
(b) GLOCKER, R., HAYER, E., and JÜNGLING, O.: Über die biologische Wirkung verschiedener R-Einheiten. Strahlentherapie, 1929, XXXII, 1-38.

(4) CHRISTEN, TH.: Messung und Dosierung Röntgenstrahlen, Hamburg, 1913.

(5) In the electrometric measurement of ionization, this product is measured directly as the total charge of the electrometer.

(6) Different biologic objects have different sensitivities. The knowledge of the absolute value of dose would mean no simplification in dosimetry.

(7) Strahlentherapie, 1929, XXXIII, 704.

(8) Naturwiss., 1931, XIX, 251.

(9) Anna. d. Phys., 1930, V, 475.

(10) Proc. Roy. Soc., 1908, LXXX, 599.

(11) Anna. d. Phys., 1929, II, 94.

(12) GLOCKER, R., HAYER, E., and JÜNGLING, O.: See reference under No. 3-b.

(13) Exact measurements are lacking; the values can be obtained only by interpolation.

(14) HOLWECK, F.: Production de rayons X monochromatiques de grande longeur d'onde. Action quantique sur les microbes. Compt. Rend., 1929, CLXXXVIII, 197-199; 1930, CXC, 527.

(15) WYCKOFF, R. W. G.: Killing of Certain Bacteria by X-rays. Jour. Exper. Med., 1930, LII, 435.

HORMONE PRODUCTION MAY DEPEND ON MANGANESE

Studies indicating that the formation of a hormone by the pituitary gland is in some way related to the manganese of our daily diet have been described by Dr. E. V. McCollum, of the Johns Hopkins School of Hygiene and Public Health, at the meeting of the National Academy of Sciences. He pointed out the relation of iodine to the thyroid gland, of calcium to the parathyroid glands, and said that apparently another glandular system had been linked with an inorganic element which is essential to the diet.

Rats deprived of manganese exhibit strange behavior and bodily changes, Dr. McCollum and his associate, Dr. Elsa Orent, have found. The sex glands of the male rats degenerate until complete sterility results. The females, however, continue to have litters of living young but do not show any sign of ordinary maternal solicitude. Normal mothers seem to detect something wrong with the young of manganese-free mothers and abandon them, although normal rats will ordinarily care for each other's young when the litters are exchanged. "The addition to the manganese-free diet of as little as five-thousandths of 1 per cent of manganese results in correcting the behavior of the female rats toward their young," Dr. McCollum said.

Other workers have reported that male sterility in middle life is related to deficiency of the pituitary hormone, and that the pituitary gland stimulates milk secretion. Dr. McCollum suggested that since manganese-deprivation had the same effect, the dietary manganese may be related in some way to hormone formation by the pituitary gland. However, there is no need to worry over possible lack of manganese, as one worries over lack of vitamins, it appears, for Dr. McCollum reported that at the beginning of the experiments great difficulty was encountered in removing manganese completely from the diet.—*Science Service.*

INTERNATIONAL COMPARISON OF X-RAY STANDARDS[1]

By LAURISTON S. TAYLOR, WASHINGTON, D. C.

Abstract.—Direct comparisons between the X-ray ionization standards of the United States, England, Germany, and France are described. The small guarded field ionization chamber was used as the working standard and transported to the several laboratories. Careful check of the instrument calibration at each laboratory showed no change due to transportation. Complete corrections were made for air absorption, differences in current measurements, and differences between chamber diaphragms. The final agreement between the United States, English, and German standards was ±0.5 per cent. The ratio between the international roentgen and Solomon's unit for hard radiation (H.V.L. greater than 0.75 mm. Cu) was 2.29. As a result of diaphragm discrepancies found in England, a study of diaphragm measurements was made. It was found that lead diaphragms tended to warp with age, rendering difficult an accurate determination of their area. Plug gauge and micrometer microscope measurements were averaged for the final results.

I. INTRODUCTION

THE unit of X-ray quantity known as the "roentgen" has within the last few years become very generally used in applied radiology. In the meantime, many investigators have studied the problem of devising an equipment which will unambiguously measure an X-ray beam according to the definition of the international roentgen as proposed by the Second International Congress of Radiology in 1928[2] and many important features overlooked by the earlier investigators have been brought out.[3] There has at the same time been set up in the national laboratories of England, Germany, and the United States standard open-air ionization chambers in terms of which dosage meters for the particular country are calibrated.[4, 5, 6]

Other countries, not having centralized standardization laboratories, have designated certain private or state institutions as recognized custodians of the standard. In France, Dr. I. Solomon, at L'Hôpital St. Antoine, is the official custodian.

Since the different national standards have been designed and constructed independently, it is natural to find that no two are exactly alike, even though the basic principles involved in all are the same. On account of these differences the most obvious question was how closely these several standards agreed.

The first attempt at comparison was made in 1927 by Behnken.[7] For this purpose he carried a pair of carefully controlled thimble chambers, which had been calibrated against his standard, to several laboratories for comparison. His results revealed a difference between several American laboratories (not including the Bureau of Standards, since we had no X-ray standardization equipment at that time) and the Physikalisch-technische Reichsanstalt of some ±4 per cent. More recent studies[8, 9] have shown that an ambiguous calibration is ex-

[1]Preliminary report read by L. S. Taylor at the Third International Congress of Radiology, Paris, July 29, 1931.

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[2]The roentgen is defined as "the quantity of X-radiation which, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimeter of atmospheric air at 0° C. and 760 cm. mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current."

[3]L. S. Taylor, RADIOLOGY, January, 1931, XVI, 1-13.

[4]H. Behnken, Strahlentherapie, 1927, XXVI, 79.

[5]L. S. Taylor, Bureau of Standards Jour. Research (R.P. 56), 1929, II, 771.

[6]G. W. C. Kaye and W. Binks, British Jour. Radiol., December, 1929, II, 553-578.

[7]H. Behnken, Strahlentherapie, 1928, XXIX, 192-198.

[8]L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 169), 1930, IV, 631.

[9]L. S. Taylor and G. Singer, RADIOLOGY, August, 1930, XV, 227-240.

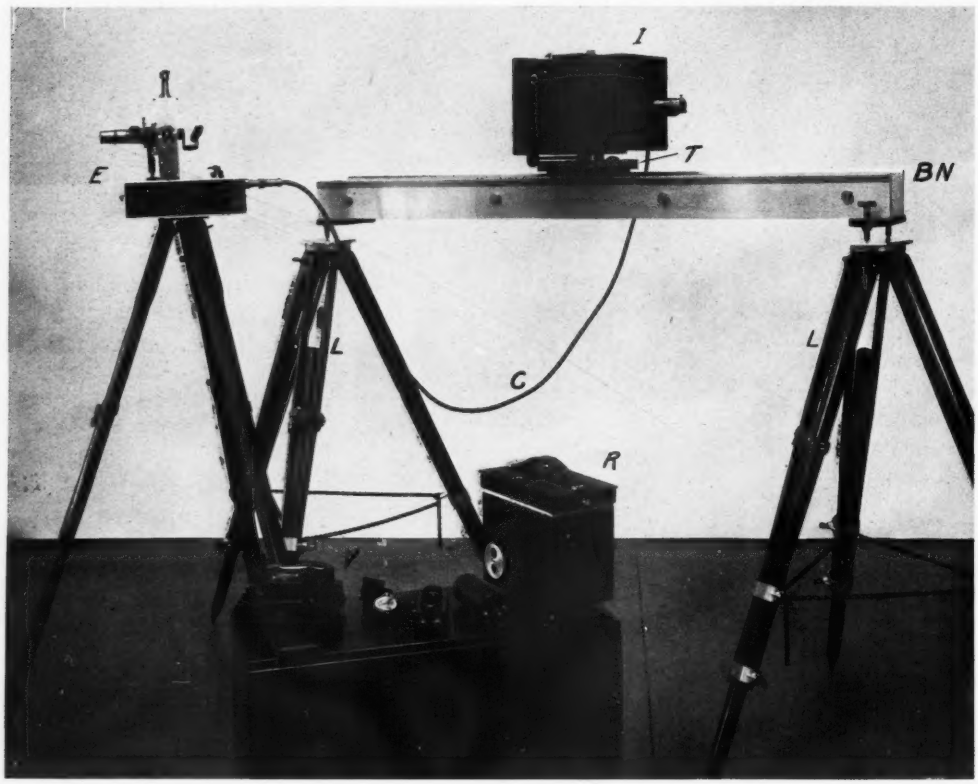

Fig. 1. Photograph of complete X-ray standardization equipment.

ceedingly difficult. Behnken's comparison measurements were made with a magnesium thimble chamber which, therefore, had a considerable dependence upon the radiation quality as compared with an open-air ionization chamber. The impossibility of reproducing the necessary radiation qualities in the different laboratories consequently influenced accuracy of the measurements in an unfavorable way.

It appeared, therefore, that a direct comparison among the standards themselves would be the only reliable method.[10] This has heretofore been practically precluded by the very great weight and size of these open-air standards. The guarded field ionization chamber developed in this laboratory[11, 12] appeared, however, to be sufficiently compact to transport, so the Bureau arranged for a comparison with the national laboratories of England, Germany, and with Dr. Solomon's laboratory of France.

II. PORTABLE X-RAY STANDARDIZATION EQUIPMENT

(1) Description of Apparatus

The working standard used in these comparisons was a small guarded field ionization chamber previously described[11, 12] though some minor modifications from that

[10] L. S. Taylor, RADIOLOGY, June, 1930, XIV, 551-556.

[11] L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 211), 1930, V, 507.

[12] L. S. Taylor and G. Singer, RADIOLOGY, December, 1930. XV, 637-646.

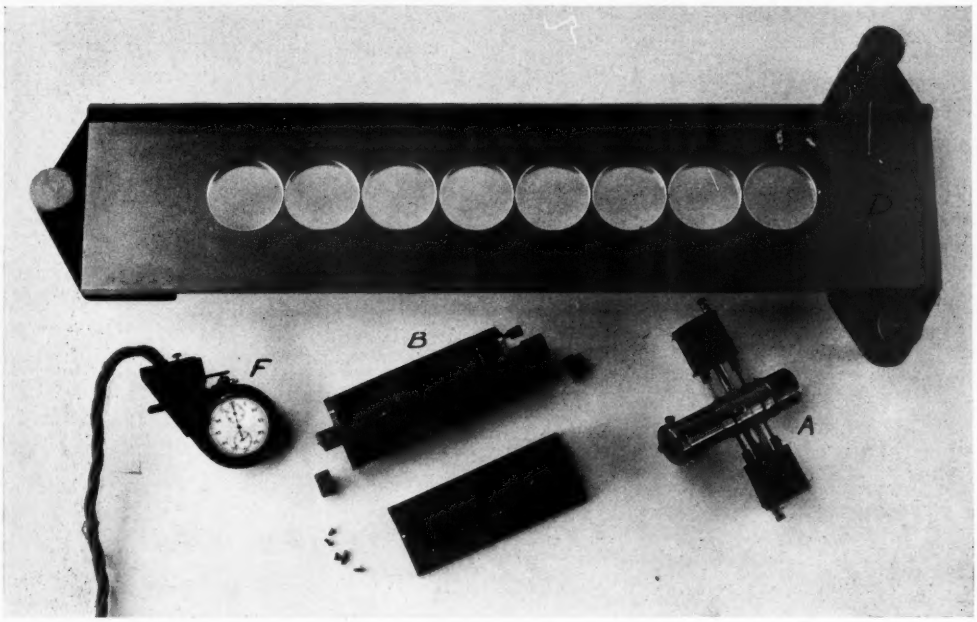

Fig. 2. Accessory equipment.

description were made to facilitate the more ready alignment in the X-ray beam. At the same time, the beam was isolated from the guard wires by reducing their number from 12 to 8, which permitted a spacing of 1.8 cm. between the central pair. With the chamber diaphragm of only 0.8 cm. diameter there was little likelihood of the beam striking the wires unless the chamber was placed abnormally close to the tube. The change in spacing of the guard wires necessitated, however, an increase of 3 cm. in the length of the surrounding box to maintain a uniform electric field between the collector plates. To insure ruggedness the older potential dividing resistors of carbon were replaced by wire-wound resistors.

The current measuring system used (*E*, Fig. 1) has already been described.[13, 14] In this, the electric charge furnished by the ionization chamber is entirely localized in a condenser which has one plate connected to the ionization chamber collector electrode and the other to a source of continuously variable potential. The localization is effected by maintaining the receiving line at a constant potential by properly changing the variable potential. This change in potential measures the accumulated charge. The null reading electrometer is connected to the ionization chamber *(I)* by a flexible rubber cable *(C)* surrounded by an earthed copper sheath. It may be noted that since, in the current measurements, the potential of the system is maintained at zero, cable leakage plays no part in the magnitude, but merely affects the sensitivity.

To derive the current, two different timing devices were used as circumstances demanded. The first was a magnetically operated lead shutter (*A*, Fig. 2) to fix the ex-

[13] L. S. Taylor, Bureau of Standards Jour. Research (R.P. 306), 1931, VI, 807.

[14] L. S. Taylor, RADIOLOGY, August, 1931, XVII. 294-303.

posure interval to the X-ray beam entering the ionization chamber. The second was a magnetically operated switch *(B)*, placed in the electrometer circuit to disconnect the measuring system from the ionization chamber. The second method is less desirable than the first, because breaking the connection changes the capacity of the system, this requiring that the electric switch be operated only when the electrometer indicates zero potential, and that no adjustment of the compensator be made after opening the switch.

Both shutter and magnetic switch are operated and timed by means of a combined stop watch and two-way switch (*F*, Fig. 2). The switch is adjusted to operate at the instant the stop watch is started and stopped, during which interval the operator balances the ionization current by changing the voltage V of the compensating condenser. The ratio of the compensating voltage V to the interval t is proportional to the ionization current.

Saturation voltage for the ionization chamber was supplied from a compact 2,000-volt kenotron rectifier (*R*, Fig. 1), having a filter capacity of 1 micro-farad. The current drawn off by the potential divider for the guard wires, being only 4×10^{-4} amperes, introduces no appreciable ripplage in the saturation voltage.

The ionization chamber was mounted on a swivel table and short cross slide *(T)*, for adjustment in a direction at right-angles to the beam in the horizontal plane; and the cross slide in turn mounted on an aluminum optical bench *(BN)* for adjustment along the beam. Two such benches were used—one 5 feet long *(B)* and the other about 20 inches (*D*, Fig. 2). A pair of rugged adjustable tripods *(L)* were used for supporting the optical benches.

For transportation, the entire equipment and a few spare parts were placed in the three cases. The two smaller ones containing the chamber, electrostatic compensator *(E)*, and voltmeter *(V)* were carried by hand throughout the journey, while the large one containing the accessories and 2,000-volt generator was shipped.

(2) Accuracy of Calibration

The accuracy of the compensator depends solely upon the fixed capacity in the compensator case. The calibration of this capacity was checked in each laboratory before it was used. The values of the calibration constant k_0,[15] as obtained at the various places, are given in Table I. In addition, a complete calibration of the fixed capacity of the compensator was also carried out in Teddington, giving a value of 828.4 $\mu\mu$f as compared with 828.2 $\mu\mu$f, obtained before leaving and after returning to Washington. In the final calibration, a variable capacity was used with its series of capacity differences accurate to within 1/10 per cent. No deviation from the mean in any determination exceeded 1/10 per cent.

The voltmeter used for measuring the compensating potential was corrected to 1/10 per cent; a number of checks during the journey indicated that no changes occurred in transit.

Our earlier investigations led to a definite set of requirements which were adhered to as closely as possible in all comparisons. First, a replacement method of measuring the radiation was chosen since it eliminates any uncertainty as to quality variations over the area of the beam; then it is necessary to have the X-ray beam uniform over the area of the chamber diaphragm. Experience has shown that this must be tested for each set-up; visual alignment may lead to error.

Corrections for loss of radiation by absorption in the air between the chamber diaphragm and collector electrode were also

[15] k_0 is the ratio of the potentials V_0/v_0 where v_0 is the potential induced on the insulated system by the application of V_0 to the compensator condenser, when all external capacities are removed from the compensator. A determination of k_0 serves as a check on the calibration of the capacity.

TABLE I.—COMPENSATOR CALIBRATION CONSTANTS (K_0) OBTAINED IN DIFFERENT LABORATORIES

	k_0
Washington (May 1, 1931)	1.045_2
Teddington (N.P.L.)	1.045_7
Berlin (P.T.R.)	1.045_4
Paris (L'Hôpital St. Antoine)	1.046_2
Washington (Sept. 4, 1931)	1.045_0

TABLE II.—COMPARISON OF COMPENSATORS WITH MEMORIAL HOSPITAL

Radium compensator	Electrostatic compensator	Per cent difference	Average deviation B.S.
13.11 e.s.u.	13.18 e.s.u.	—.53	±0.9%
1.248	1.242	+.24	±0.2%
0.597	0.593	+.66	±0.2%
		Average +.12	

considered necessary, though with the guarded field chamber this correction has been reduced to a minimum which is negligible for the highly filtered radiations. With some of the larger air chambers, however, this cannot be neglected anywhere within the practical range of wave lengths.

Data for the absorption of heterogeneous radiation in air are very incomplete, hence it was deemed necessary to interpolate between known coefficients for many radiation qualities encountered.[16, 17] The values in this work so obtained are probably accurate to within about 15 per cent.

III. COMPARISONS IN THIS COUNTRY

Measurements have been previously described which show an average agreement between the large open air ionization and the earlier guarded field (12 wire) chamber, closer than 0.1 per cent.[18] Comparisons between the earlier 12-wire chamber and the present 8-wire chamber showed agreement within 0.2 per cent.

In co-operation with Dr. G. Failla, a comparison of the Bureau's current measur-

[16] M. Siegbahn, The Spectroscopy of X-rays, Appendix Table III, Oxford University Press, London, 1925.

[17] L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 271), 1931, VI, 219.

[18] L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 211), 1930, V, 507.

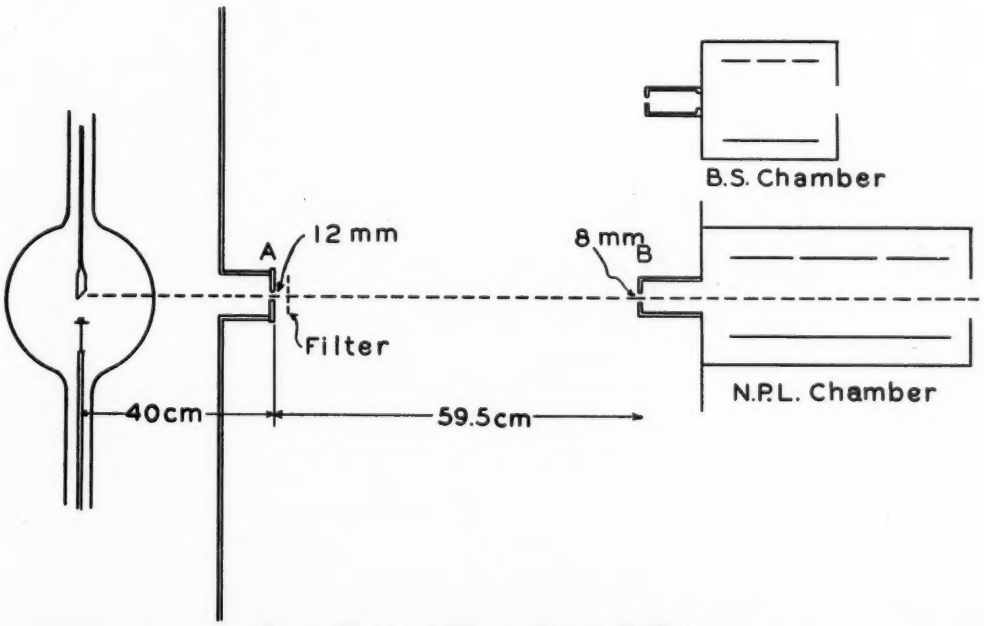

Fig. 3. Diagram of X-ray system in Teddington.

ing system with that of Memorial Hospital of New York[19] was made, theirs being the only laboratory in this country which uses null compensation methods. This was primarily to be certain that our system would stand transportation. For comparison, the B. S. compensator was simply connected directly to Failla's calibrated radium ionization chamber. With a steady potential applied to the radium chamber, the resultant current was compensated for a convenient length of time. Measurements over a 20-fold range of current are given in Table II.

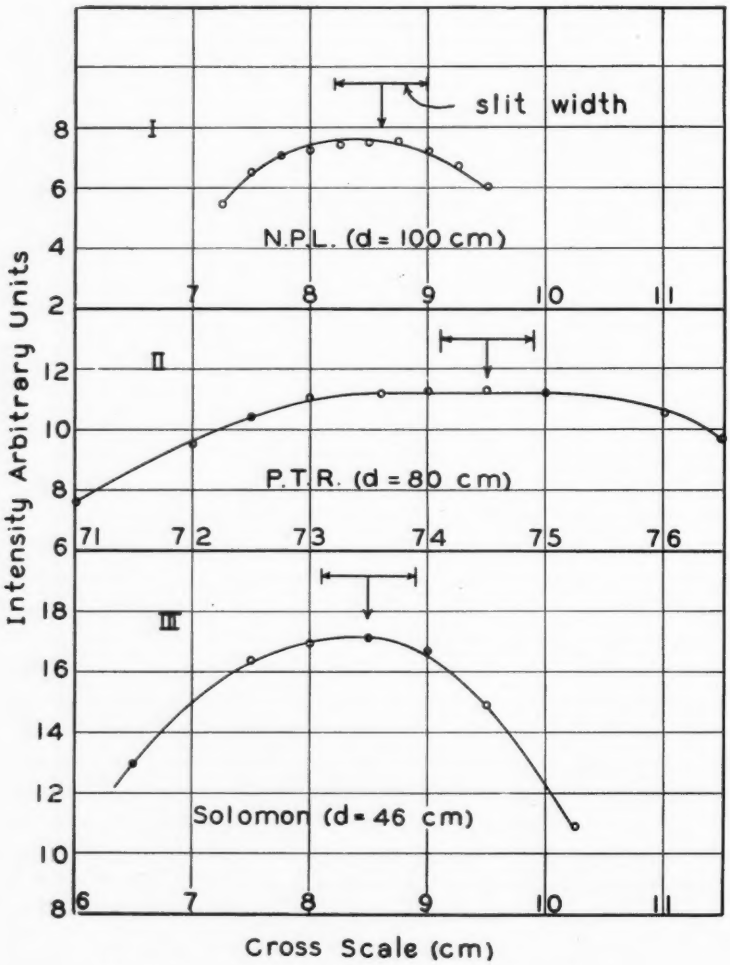

Fig. 4. X-ray intensity distribution across X-ray beams.

It will be noticed that the small differences are progressive, the radium compensator readings becoming more negative with respect to Bureau readings as smaller currents were used.

[19] G. Failla and P. S. Henshaw, RADIOLOGY, July, 1931, XVII, 1-43.

IV. COMPARISON WITH NATIONAL PHYSICAL LABORATORY

(With the co-operation of Dr. G. W. C. Kaye and Mr. W. Binks)

The new N.P.L. chamber is of the Duane type with a 10-cm. plate spacing. A diagram of the set-up for making the comparison is shown in Figure 3. Their X-ray tube, of the Coolidge deep therapy type, was in a horizontal lead box with a limiting diaphragm *(A)*, 12 mm. in diameter, at about 40 cm. from the target. The ionization chamber diaphragm *(B)* was 8 mm. in diameter. The collector electrode *(C)* had a nominal effective length of 8 cm. and its center was approximately 35 cm. from the diaphragm. They used a null electrostatic compensator to measure the ionization current. Both ionization chambers were mounted on a short cross slide which was, in turn, mounted on a heavy optical bench. (It happened that the Bureau chamber fitted exactly on the N.P.L. track.) The replacement method of observation was used, the two chambers being shifted alternately to position for observation. This distance was so fixed that the front face of the chamber diaphragm was in both cases at the same distance from the target (about 100 centimeters).

Curve I, Figure 4, shows in arbitrary units the distribution of intensity across the X-ray beam as obtained by moving the chamber across it. It should be pointed out that the relative narrowness of such a peak is largely due to the effective slit width of the chamber diaphragm used to "explore" the beam. Some measurements made with a smaller diaphragm indicated a more nearly uniform distribution. In any case both chambers were very sensitive to alignment. The operating position of the chambers in the beam is indicated by the arrow.

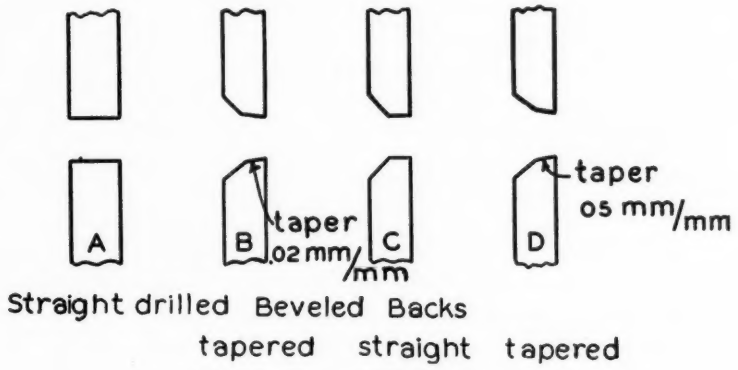

Fig. 5. Types of diaphragms used.

The two compensating systems were separately compared by using them alternately to measure the ionization in the N.P.L. chamber while the X-ray output was maintained constant according to meter readings. In this comparison the B.S. instrument read 1.47 per cent higher than that of the N.P.L.

During the comparison of chambers it was found that the chamber diaphragms of the two equipments had different effective areas not accounted for by the difference in their diameters. The N.P.L. diaphragm was about 9 mm. thick and the hole was cylindrical (*A*, Fig. 5). The B.S. diaphragm (*B*, Fig. 5) had a taper of .02 mm. per mm. length and was approximately only 4 mm. thick along the face of the hole. Depending upon such factors as the focal spot diam-

TABLE III.—COMPARISONS WITH THE NATIONAL PHYSICAL LABORATORY

Run	K.V.	Filter Cu	H.V.L. (copper)	r/min. B.S. observed	r/min. N.P.L. observed	Air absorption correction	Corrected for air absorption	B.S./N.P.L. per cent difference after correction	Corrected for diaphragms	B.S./N.P.L. per cent difference after correction	B. S. precision
1	110	0	0.11	4.30	3.98	1.5%	4.04	—6.2	4.26	—0.93	±1.2%
2	110	0	0.11	4.51	4.13	1.5%	4.19	—7.4	4.33	—1.9	±0.7%
3	143	0.14	0.5	1.295	1.205	0.6%	1.21	—6.4	1.28	—1.32	±0.9%
4	110	0	0.11	4.32	4.14	1.5%	4.20	—2.82	.....	—2.82	±1.1%
5	110	0	0.11	4.24	4.08	1.5%	4.14	—2.39	.....	—2.39	±0.8%
								Average difference of intact systems		—1.38 per cent	
								Corrected for compensator differences		+0.09 per cent	
								Average difference when using the same diaphragms		—2.61 per cent	
								Corrected for compensator differences		—1.14 per cent	

eter and the distance from target to diaphragm, the two types of diaphragm were found to yield different results. Some measurements made at the same time by the laboratory in Washington, and described below, illustrate this variation.

As dictated by the type of construction, the difference in the distance between the diaphragm and center of the collector for the two chambers amounts to about 15 centimeters; hence the comparatively soft radiation used necessitated corrections for air absorption. These were obtained by interpolation from previous data.[20]

The final results of the comparisons are summarized in Table III. In giving percentages, the N.P.L. readings are referred as a basis to the guarded field chamber. Runs No. 1 and No. 2 are straightforward comparisons; Run No. 3 was made with the tube diaphragm increased in diameter from 12 to 30 millimeters, and Runs No. 4 and No. 5 were made with the B.S. diaphragms on both chambers, hence in this case no diaphragm area corrections of the N.P.L. readings were necessary. This correction for Runs Nos. 1–3 amounted to 5.4 per cent as obtained experimentally. Because of the fact that the diaphragm corrections were unnecessary, the last two runs are probably the most reliable.

The last column, indicating the average deviation from the mean for the observations made with the B.S. chamber, reveals the effect of the unsteadiness of the X-ray generator, since under the best conditions of operation this average deviation is about ±0.2 per cent.

From these comparisons, we may conclude that the agreement between the chambers alone is probably within the experimental error when using the same diaphragms or correcting for their differences. As the two chambers initially stood, there was a difference of some 9 per cent, which was reduced only by the corrections for air absorption, diaphragms, and compensator differences.

V. COMPARISON WITH THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

(With the co-operation of Dr. Behnken and Dr. Jaeger)

The standard ionization chamber used by the P.T.R. is of the large cylindrical type

[20] See Footnote 12.

described by Behnken.[21] Their X-ray tube is supported vertically in a large lead box (Fig. 6). The limiting tube diaphragm is a 3-cm. opening in a lead rubber cylinder placed about 5 cm. from the tube walls. The chamber diaphragm is of the cylindrical type, 7 mm. in diameter. The collector electrode of the ionization chamber is 30 cm. long, with its center approximately 40 cm. from the chamber diaphragm. A uranium oxide compensator with a null electrometer indicator is used to balance the ionization current.[22] Their chamber is mounted on a table movable on a track on the floor in a direction parallel to the beam.

The B.S. chamber was mounted on the long optical bench, supported on two tripods, placed at right-angles to the beam and at such a height that the P.T.R. chamber in taking its forward position could pass above it. In the operating position the distance from target to chamber diaphragm and the section of the beam intercepted was the same for both chambers. The replacement method of observation was also used here.

To check the constancy of the output of the X-ray tube, a thimble chamber was maintained in the beam just off the axis (Fig. 6).

The distribution of intensity across the X-ray beam as obtained by the B.S. chamber is shown in Curve II of Figure 4. The beam is seen to be uniform within experimental limits over a wide area, so that a critical alignment of the chambers was not necessary. The working position of both chambers is indicated by the arrows.

The diaphragms of the two chambers had the same thickness, so a negligible difference arising therefrom is to be expected. This proved to be the case as indicated by some subsequent measurements.

The difference in the distances between chamber diaphragm and center of collector for the two chambers was 20 centimeters. Comparatively hard radiations, entailing

[21] See Footnote 4.
[22] R. Jaeger, Strahlentherapie, 1920, XXXIII, 542-550.

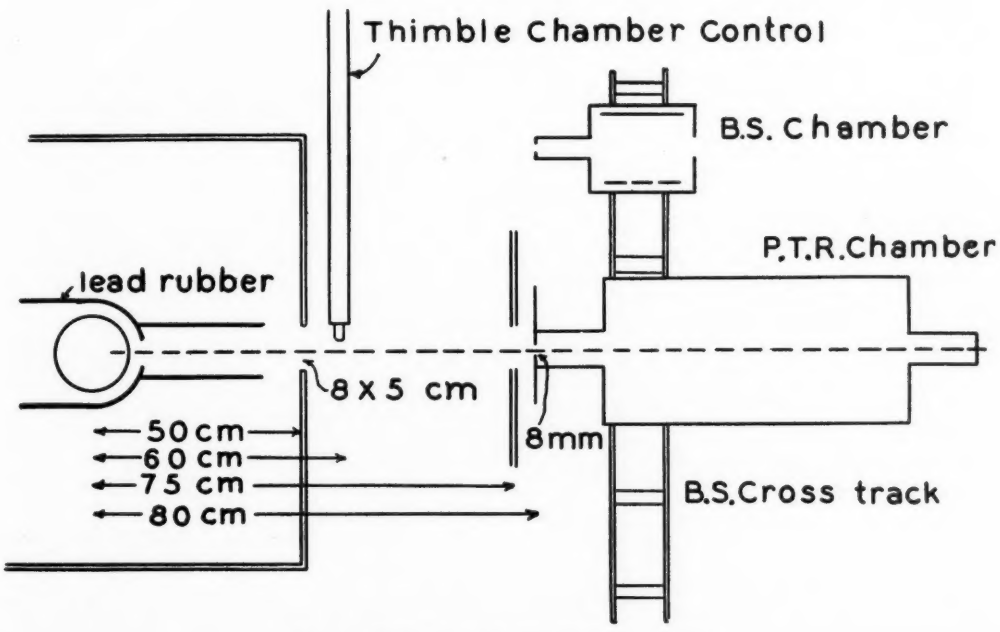

Fig. 6. Diagram of X-ray system in Berlin.

TABLE IV.—COMPARISON OF COMPENSATORS AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

Uranium oxide current amp $\times 10^{-12}$	Electrostatic compensator amp $\times 10^{-12}$	Difference	Average deviation from mean
133	134.0	+0.75 per cent	±0.31 per cent
206	207.1	+0.53 per cent	±0.60 per cent
280	281.2	+0.43 per cent	±0.57 per cent
		Average +0.58 per cent	

TABLE V.—COMPARISON WITH THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT

Run	K.V.	Filter	H.V.L. (mm. Cu)	r/min. B.S.	r/min. P.T.R.	Air absorption correction	Corrected for air absorption	Per cent difference	B.S. precision
1	100	2.0 Al	0.16	0.0515	0.0503	1.2 per cent	0.0509	—1.17	±0.38 per cent
2	150	0.5 Cu +1.0 Al	0.75	0.0457	0.0460	0.6 per cent	0.0463	+1.11	±0.5 per cent
3	180	0.7 Cu +1.0 Al	1.1	0.0476	0.0471	0.4 per cent	0.0473	—0.68	±0.25 per cent
								Average	—0.25 per cent
								Compensator correction	—0.6 per cent
								Chamber difference	+0.35 per cent

small air absorption connections, were used in most of the measurements.

The electrostatic and uranium oxide compensators were compared directly in the same manner as with Failla. The results are given in Table IV, referred to the B.S. compensator as a basis.

The P.T.R. compensator registers a somewhat smaller magnitude than the B.S. compensator. It will also be noted that the variations are progressive, but in the opposite direction from Failla's. The range of currents in this case is about 1/10 of that used in Failla's laboratory.

The comparison as a whole is given in Table V. The only corrections made were for air absorption in the P.T.R. chamber.

VI. COMPARISON WITH FRENCH STANDARD

(At L'Hôpital St. Antoine, with the cooperation of Dr. I. Solomon)

At the time of these measurements, the recognized French X-ray standard, measured in terms of Solomon's unit, was known as the R. This was accomplished with a specific thimble chamber calibrated in terms of the ionization produced by radium under a given set of conditions.[23]

Differences in the apparatus, and the general experimental conditions, necessitated a comparison procedure different from that followed with N.P.L. and P.T.R. A fairly broad X-ray beam was used as a source and measurements made with the two chambers simultaneously in two different parts of the beam. This necessitated placing the Solomon chamber in the beam sufficiently far off the axis so that it did not affect in any way the radiation entering the B.S. chamber. This position was such that it was impossible to see the thimble chamber when sighting back through the B.S. diaphragms.

The X-ray tube was placed in a horizontal, oil-filled tank so that the radiation passed through a constant filter of 20 mm.

[23] I. Solomon, Jour. de Rad. et d'Elec., 1924, VIII, 851; 1926, X, 155; 1927, XI, 286.

of oil + 1.0 mm. of aluminum. The tube tank was not sufficiently adjustable to provide a horizontal X-ray beam; and, since the B.S. equipment could not well be used vertically, the beam was brought out at an angle of about 30° with the horizontal. The short optical bench supported by tripods of different heights was inclined at this angle (Fig. 7). The limiting diaphragm was about 3 cm. in diameter. The thimble chamber had an effective length of about 3 cm. and was placed 44.5 cm. from the X-ray tube target and just off the center of the beam entering the B.S. chamber. The front diaphragm of the B.S. chamber was 58.2 cm. from the X-ray tube target. As checked later, radiation scattered from the B.S. chamber did not produce a detectable effect on the thimble chamber readings.

Curve III in Figure 4 shows the distribu-

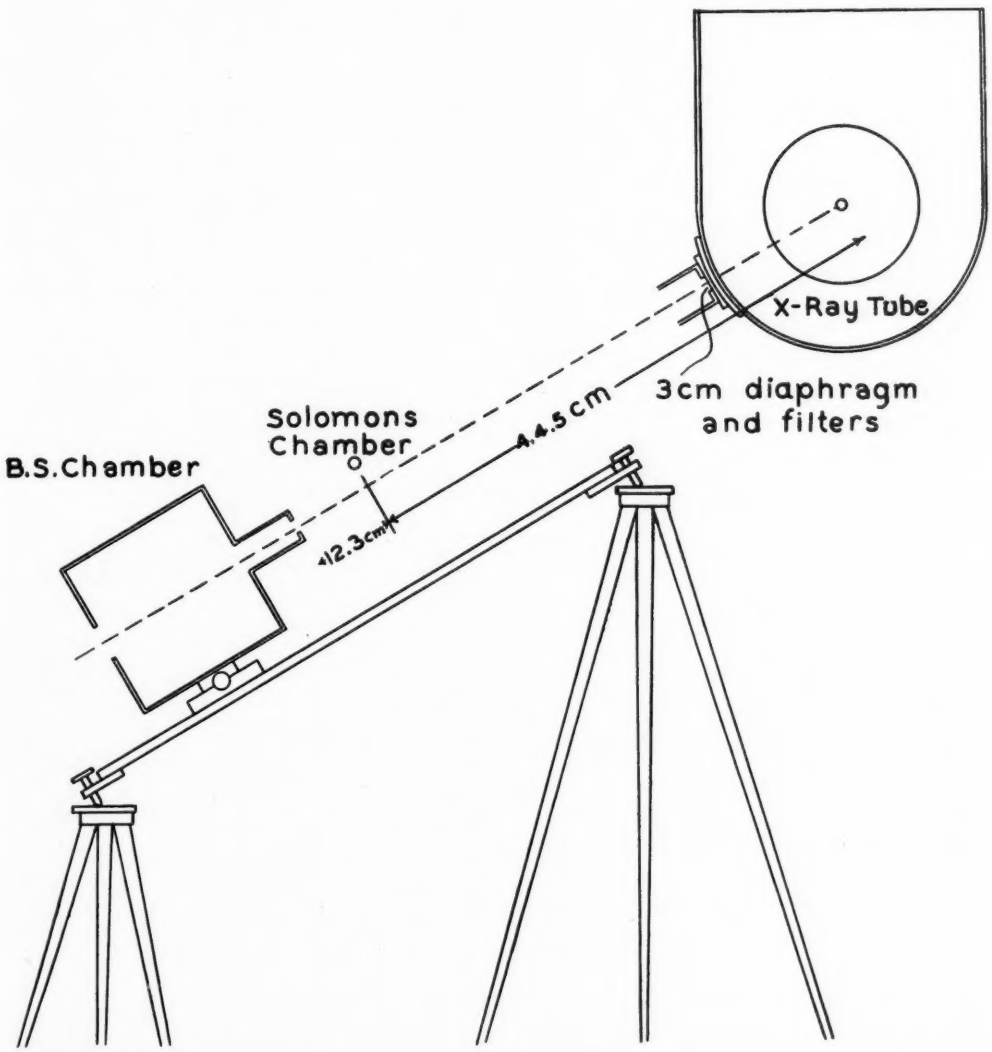

Fig. 7. Diagram of X-ray system in Paris.

TABLE VI.—COMPARISON WITH DR. I. SOLOMON AT L'HÔPITAL ST. ANTOINE

Run	K.V.	Filter (mm.) (+1.0 Al + 20 mm. oil)	Half value layer in copper	r/min. B.S.	R/min. Solomon	Corrected for inverse square law	Corrected for leakage	Air absorption correction	Corrected for air absorption	Ratio B.S. unit/ Sol. unit
1	110	0	0.25	5.81	22.5	13.15	12.49	0.5 per cent	12.18	2.10
2	150	0.4 Cu	0.75	3.47	14.5	8.48	8.06	1.0 per cent	7.94	2.28
3	190	0.5 Cu	1.0	5.85	24.8	14.50	13.77	1.5 per cent	13.63	2.29
4	190	1.0 Cu	1.5	3.85	16.0	9.37	8.90	2.5 per cent	8.85	2.30

tion of intensity across the X-ray beam as obtained by the B.S. chamber. The working positions of both chambers are indicated by the arrows.

Corrections are necessary in this case for the inverse square law and air absorption. The former was applied for the difference in distance of the thimble chamber axis and the front of the B.S. chamber diaphragm from the target. This required that the readings of the thimble chamber be multiplied by a factor of 0.585. The latter was applied for the distance between thimble chamber and the B.S. collector electrode—a distance of approximately 26 centimeters. Absorption coefficients were taken from available data. However, as a rough check on these corrections they were also obtained experimentally by moving the thimble chamber in a direction along the beam axis. This could not be done with very great accuracy but the results indicated the corrections used were valid within the experimental limits.

A further correction for temperature and pressure is necessary in this case because the Solomon unit is defined for room temperature. Since the measurements were made at 19°C. and 762 mm. mercury, a factor of 6.97 per cent was applied to the B.S. chamber readings. The average deviation from the mean for all the observations was about ±0.4 per cent.

Table VI gives the results.

It will be noted that for the harder radiation (H.V.L. = 1.0 mm. Cu) the Solomon chamber is almost independent of the quality. However, in going to the softer radiation (H.V.L. = 0.25 mm. Cu) a change of about 9 per cent apparently takes place. Considering, therefore, only the harder radiation, we find that 1 r = 2.29 R as compared with 1 r = 2.2 R, found earlier by Solomon for the same chamber, which may be counted very good agreement.

As a result of this comparison, Dr. Solomon has adopted as his fundamental standard a guarded field ionization chamber identical with that used here.

VII. STUDY OF IONIZATION CHAMBER DIAPHRAGMS

(By G. Singer, Bureau of Standards)[24]

The relatively large difference between the effective areas of the chamber diaphragms used by the N.P.L. and B.S. was unexpected, since earlier ionization measurements at the Bureau of Standards on tapered diaphragms had not indicated any appreciable difference.[25] However, if the source of radiation be larger than the diaphragm aperture, some of the radiation incident on the opening strikes the cylindrical wall of the hole in the diaphragm and is effectively cut off (*a*, Fig. 8). This shifts the effective target-diaphragm position from the outer face toward the inner face of the diaphragm, and

[24] Washington, June 28, 1931.

[25] L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 169), 1930, IV, 631. In reviewing this work it was found that the experimental conditions were not sufficiently like those described above to warrant comparison.

causes an effective shrinking of the diaphragm opening.

The taper diaphragm (*b*, Fig. 8) does not present this difficulty if used far enough from the target to prevent radiation hitting the wall of the aperture. It has the disadvantage, however, of introducing arbitrary factors in the diaphragming system. Furthermore, with steep tapers, the front edge of the diaphragm may actually transmit some radiation.

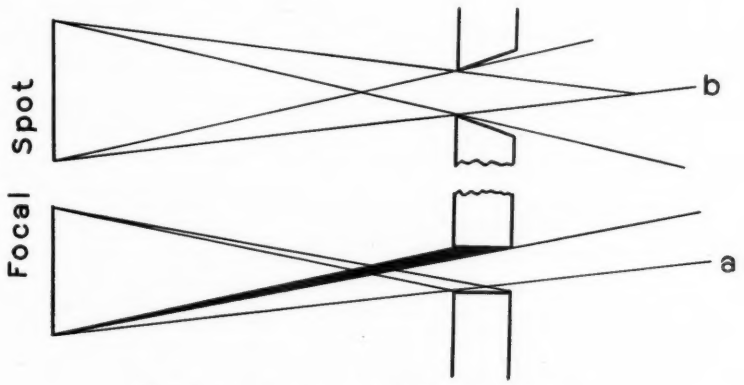

Fig. 8. Effect of thick and tapered diaphragms.

As a result of the discrepancy between the N.P.L. and B.S. measurements, three carefully constructed diaphragms of the types shown in Figure 5, *A*, *C*, *D*, were compared at the Bureau of Standards. These were used successively on the ionization chamber at a distance of 100 cm. from the target and ionization measurements made for the same X-ray output.

The actual measurements of the diaphragms are given in Table VII. Diaphragms *A* and *C* were both drilled and reamed without taper in lead-bismuth plates 10 mm. thick, *C* then being beveled off at the back to give a resultant thickness of 4 millimeters.[26] From the explanation given above they should differ in transmission by roughly 1.2 per cent. The diaphragm *B* was the same as those used on the B.S. chamber in Europe, having a taper of 0.02 mm. per mm. on the radius and a thickness of 4 mm. up to the bevel. Diaphragm *B*, at a distance of 100 cm. from the target, should transmit all the radiation incident on the front of the aperture, and, neglecting transmission through its edges, should pass approximately 0.4 per cent more radiation than the thin straight-walled diaphragm *C*. The diaphragm *D* had about two and one-half times the taper of *B* and was used in these measurements solely to bring out more clearly the effect of the tapered walls.

To compare the effective areas or transmissions of these diaphragms, the volume of air ionized within the chamber is calculated from the measurements of the diaphragm diameter, and from this in turn is determined the ionization per cubic centimeter (I_{cc}) of air.[27] I_{cc} is, of course, directly proportional to the effective diaphragm opening. The results are given in Table VIII.

The diaphragm *C* (thin, straight walls) is used as a base in the experimental and calculated values of I_{cc}, both being taken as 100. The agreement between the two sets of

[26] This type of diaphragm has always been used in previous experiments at the Bureau of Standards.

[27] L. S. Taylor, Bureau of Standards Jour. Research.

TABLE VII.—DIAMETER MEASUREMENTS OF LEAD-BISMUTH ALLOY DIAPHRAGMS MADE BY BUREAU OF STANDARDS GAGE SECTION

Diaphragm	Microscope			Plug gage (mm.)	Adopted value (mm.)
	Front face (mm.)	Back face (mm.)	Mean (mm.)		
A	8.041	8.037	8.042	8.024	8.033
	8.046	8.043	.....	.....	
B	7.993[1]	8.159[1]	7.993[2]	.....	7.993
C	8.038	8.044	8.038	8.016	8.027
	8.028	8.039	.....	.....	
D	8.032	8.376	8.040[2]	8.034	8.037
	8.047	8.379	.....	.....	
B (by Binks[3])	8.005	8.170	8.005[2]	.....	8.005

[1]Average of readings taken for 6 diameters.
[2]Average for diameter of front face.
[3]Measurements made by Binks in Teddington. It will be noted that they differ from our measurements by only 0.15 per cent.

TABLE VIII.—COMPARATIVE IONIZATIONS PER CUBIC CENTIMETER OF AIR OBTAINED WITH DIFFERENT DIAPHRAGMS 100 CM. FROM TARGET

Diagram	I/c.c. (Exp.)	I/c.c. (Calc.)	Observational error
A	98.6	98.8	±0.17%
B	100.31	100.4	±0.20%
C	100.0	100.0	±0.17%
D	100.79	.....	±0.17%

values is as close as may be expected. It is seen, however, that the difference between *A* and *B* is only 1.7 per cent, whereas, at the N.P.L., the experimentally determined difference between essentially similar diaphragms was apparently 5.4 per cent. A possible cause of this discrepancy may lie in errors in the measurements of the diaphragms as shown below.

The accurate measurement of the diameters of the apertures presented some unexpected difficulties. The B.S. tapered diaphragms were measured by a method described by Failla[28] in which an accurately known tapered mandrel was forced a given distance into the lead-bismuth diaphragm. Binks measured two of our diaphragms while we were at Teddington, with a micrometer microscope, and found diameters of 8.005 and 8.035 mm., respectively, whereas, they were both supposed, from mandrel measurements, to be 8.000 millimeters.

To check the reliability of the microscope

[28]G. Failla, Am. Jour. Roentgenol. and Rad. Ther., January, 1929, XXI, 47-63.

or other methods, the diaphragms *A*, *B*, *C*, *D*, in Figure 5, were measured by the Gage Section of the Bureau of Standards,[29] using both the micrometer-microscope and plug-gage methods. Diaphragm *B* is the same one measured by Binks. The results given in Table VII show that the micrometer-microscope measurements are consistently larger than the plug-gage measurements. An explanation for this discrepancy is at once obvious from an exaggerated cross-section of a diaphragm in Figure 9. The microscope method measures only the face diameter of the hole, which is likely to be somewhat beveled or worn in the process of making. The plug-gage, on the other hand, measures the diametral separation between the highest projecting ridges within the bore. The diameters used in the present study were the average from the two sets of measurements and are estimated by the Gage Section to be in error by not more than 1/10 per cent.

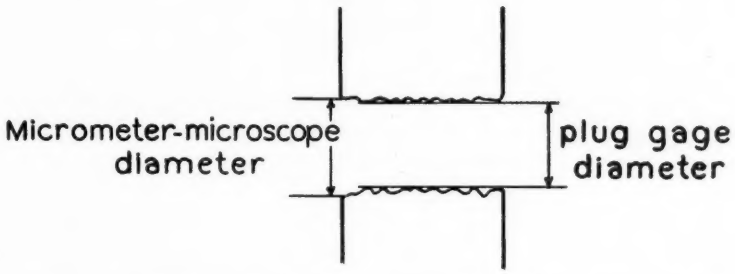

Fig. 9. Magnified cross-section of diaphragm showing where diameter measurements apply.

It should be mentioned that even when using hard lead it was found impossible to make circular holes. Warping tended invariably to make elliptically shaped openings. As a consequence, the Bureau is discontinuing the use of lead diaphragms and will in the future use a hard gold or lead-calcium alloy, the surface of which can be accurately lapped and may be relied upon to hold its dimensions.

[29]We are indebted to Dr. L. V. Judson and Dr. D. R. Miller, of the Bureau of Standards Gage Section, for their willing co-operation in this work.

VIII. CONCLUSION — JOINT RECOMMENDATIONS OF THE BUREAU OF STANDARDS, NATIONAL PHYSICAL LABORATORY, AND PHYSIKALISCH-TECHNISCHE REICHSANSTALT, AND LE SERVICE D'ÉTALONNAGE DE L'HÔPITAL ST. ANTOINE

Table IX is given to summarize the results of all the comparisons. The size of the roentgen as measured by each laboratory is referred to that measured by the B.S. chamber as a base.

Thus the agreement among the national laboratories is as close as may be reasonably expected and much better than necessary today for practical calibration purposes.

The national laboratories feel justified, therefore, in making certain recommendations which should be met by all open-air ionization chambers in order to avoid gross errors. It is believed that these are neither restrictive nor unduly arbitrary. They are:

1. The use of an X-ray tube having a focal spot as small as possible (up to 8 mm. diameter).

2. The use of a diaphragm placed as close to the tube as possible and having an aperture of such size as to shield from the ionization chamber all radiation except that from the face of the target.

3. The use of a standard chamber diaphragm having a minimum thickness but such that not more than 1/10 of the radia-

TABLE IX.—SUMMARY OF COMPARISONS MADE AMONG THE BUREAU OF STANDARDS AND FOREIGN LABORATORIES

Laboratory	Tube voltage (K.V.)	H.V.L. (mm. copper)	Size of unit (No. of units per B.S. unit)	Error in comparisons
B.S. large chamber	100-170	0.1-1.1	1.0005	+0.25 per cent
N.P.L.[1]	110-140	0.11-0.5	1.001	+0.9 per cent
N.P.L.[2]	110-140	0.11	0.9886	+0.9 per cent
N.P.L.[3]	110-140	0.11-0.5	0.996	....
P.T.R.	100-180	0.16-1.1	1.0035	+0.4 per cent
Solomon	110	0.25	2.10	+0.4 per cent
Solomon	150-190	0.75-1.5	2.29	+0.4 per cent

[1]Corrections made for diaphragm differences.
[2]Same diaphragm used on both chambers.
[3]Averaging all readings taken.

tion measured passes through the material of the diaphragm.

4. The use of a standard ionization chamber aperture of about the same diameter as the focal spot, however, not to be much smaller.

5. The utilization of only that portion of the X-ray beam in which the intensity within the experimental limits is uniform.

6. The use of the shortest distance between chamber diaphragm and collector electrode.

7. The use of a current measuring method wherein the potential difference between the guards and collector plate is negligible, preferably a null method.

Dr. Solomon has announced[30] his acceptance of the open-air ionization chamber as his fundamental standard, while at the same time recognizing the secondary calibration with radium as heretofore used by him. For this purpose he will employ an exact duplicate of the Bureau of Standards' guarded field ionization chamber as used in this investigation.

In conclusion, the author wishes to express his appreciation to the following persons whose wholehearted efforts and assistance have rendered this work possible in its entirety: Messrs. Singer and Stoneburner, of the Bureau's X-ray Laboratory, for having carried out most of the preliminary tests and measurements; Mr. Rhinebold, of our Instrument Shop, who constructed all of the apparatus, and those investigators in the foreign laboratories whose names have already been mentioned and whose complete co-operation was essential and forthcoming.

[30]Proceedings of Committee on X-ray Units of Third International Congress of Radiology (unpublished).

MEDICO-LEGAL DEPARTMENT

AN IMPORTANT DECISION
(WITH SOME PECULIAR ASPECTS)

Roentgen injury during fluoroscopy (Nelson vs. Newell (Wis.), 217 N.W.R. 723).—This action was brought for malpractice to recover damages from the defendant physician, for alleged negligent and unskillful application of the roentgen rays in such a manner as to produce what was alleged to be a third degree roentgen dermatitis. The alleged injury was the result of diagnostic application (fluoroscopy) of the roentgen rays by the defendant in this case and the subsequent application of the same agent seventeen days later by another radiologist, who, however, was not blamed by the plaintiff, nor included in the action for damages.

The issue was submitted to a jury in the Circuit Court of Racine County (Wis.), a verdict was rendered in favor of the plaintiff, and the sum of $12,500.00 damages was assessed.

Some of the testimony in the case, particularly that of the plaintiff in the case and that of a layman who had been called in as an expert witness, was decidedly fanciful and certainly contrary to established and recognized facts. The testimony of these witnesses unquestionably had considerable weight with the jury and, because the same testimony is quoted in the decision of the Supreme Court, must have had considerable weight with even those learned and erudite jurists.

The case was appealed to the Supreme Court of the State (Wisconsin) and the judgment of the lower court was affirmed. The complete opinion is as follows:

The defendant denies negligence in his answer, and alleged as a defense that the plaintiff was either hypersensitive to the X-ray, or that the burn was due to the cumulative effect of the X-ray, in an examination made by another doctor about seventeen days subsequent to the X-ray examination by the defendant. The object of an X-ray examination and the manner of the operation of the machine are quite generally known, and have been described to a considerable degree in detail in the cases involving malpractice of physicians based on the X-ray examination or treatment, so that no further explanation herein will be attempted.

On the morning of May 10, 1924, the plaintiff called at the defendant's office in order to ascertain, by the use of a fluoroscope, the cause of his apparent ill health. He was subjected to two examinations, one in the morning between the hours of 9 and 10 and one in the afternoon of the same day. The defendant testified that in the use of the fluoroscope he applied the usual and standard dose for the purposes of an examination. Plaintiff testified that after the second examination he experienced, while returning to his home, an itching sensation in the small of his back, which became more aggravated from that time until the fourth or fifth day thereafter, at which time the place where the X-ray was applied manifested an area of redness in the form of an oblong; that the itching thereafter continued; and that, seventeen days after this examination by the defendant, he called at the office of one Dr. Fortier, an X-ray specialist, of Milwaukee, where three X-ray pictures were taken, the X-ray being applied to the front of his body. Dr. Fortier was not informed at that time of the examinations made by the defendant.

On or about October 1, 1924, it became apparent that the plaintiff suffered from ulcers in the region of his back where the defendant applied the X-ray, and it is undisputed in the case that the ulcers so appearing manifested a third degree burn. There is also testimony that the ordinary and usual application of the X-ray for purposes of a fluoroscopic examination consists of a dose equivalent to 1/20 of

what is known as an erythema dose, and that an erythema dose is sufficient to create an area of redness at or around the place where the X-ray is applied. Defendant's experts testified that they had never heard of a manifestation of itching within several hours of the examination; that it occurred as a rule between 10 and 12 days after the examination; that an appearance of redness 4 or 5 days after the examination is also unusual.

In many of the cases of malpractice in which it is charged that the physician had caused the injury by the negligent use of the radiograph in fluoroscopic examinations, or by an overdose of the X-ray, or by the application of the X-ray for an excessive length of time, the defense is interposed, as in the instant case, that the patient is abnormal and hypersensitive to the X-ray treatment; and this defense has proved itself quite generally successful. It also appears in the evidence that no method has been discovered by means of which it can be determined if a given subject is hypersensitive to the X-ray. It is undisputed that cases of hypersensitiveness are extremely rare; that an X-ray burn of the third degree constitutes a serious injury, and may result in permanent injury; that a third degree burn caused by an X-ray destroys the skin and the deeper tissues of the body and also the blood vessels; and that an operation or operations connected with such an injury are extremely painful.

Dr. Dorr, one of the defendant's experts, testified that he had performed in the neighborhood of 10,000 X-ray examinations of the chest, and numerous other examinations with respect to other parts of the body; that he had in many instances applied the ordinary X-ray doses to infants within an hour after their birth; and that he had never in his practice produced a third degree X-ray burn. Dr. Epperson, also a witness for the defense, confirmed as to his practice Dr. Dorr's experience, but his practice covered in the neighborhood of 25,000 cases. Dr. Perry, the expert for the plaintiff, testified that after an examination of the plaintiff's back shortly before the trial, he was convinced that the injury constituted a third degree X-ray burn. A hypothetical question put by counsel to Dr. Perry, including substantially all of the facts shown in the evidence, elicited the answer that he knew that the burn was caused by an excessive or improper application of the X-ray, and that in his opinion the injury resulted therefrom.

The ordinary and standard dose, according to the testimony of the defendant, was applied in the instant case. Such a dose consists of 1/20 of an erythema dose. Dr. Perry also testified that in order to produce a third degree burn it would be necessary to use at least one and one-half or double an erythema dose. The jury had a right to believe this testimony of Dr. Perry, and, assuming it to be true, it will become apparent even to the mind of a layman that the use of the standard dose for examination purposes leaves an enormous factor for safety.

Absolute certainty that the injury resulted from negligence is not required in the law. Even in criminal cases, the rule is that, where a jury is satisfied beyond a reasonable doubt, the verdict of the jury will not be disturbed. In civil cases, the rule requires proof which satisfies the mind of the jury to a reasonable certainty. In this connection, therefore, if we consider the testimony of the defendant's experts, Dr. Dorr and Dr. Epperson, and in view of all of the other testimony in the case, the overwhelming probability supports the finding of the jury herein and the judgment of the court.

If a verdict such as was rendered in the instant case upon the evidence adduced therein can be set aside upon the ground of a mere speculation that the subject is one who possesses a hypersensitiveness to the X-ray, then it might be admitted that cases of this kind cannot be successfully prosecuted. The use of the X-ray in a physician's practice in modern times has become almost indispensable. Its importance cannot be overestimated. It is used in connection with all classes of injuries, and it proved of inestimable value to mankind during the recent war. The X-ray apparatus has been improved from the time of its invention, so that it has now acquired not only a remarkable degree of efficiency, but also of reliability. But, conceding the tre-

mendous value of the X-ray, it must also be admitted that the improper and negligent use thereof may result in injuries and suffering which are appalling; and notwithstanding the efficacy of this remedy, the welfare of mankind requires that a physician who operates an X-ray machine is under duty to exercise a degree of care, diligence, judgment, and skill which physicians in good standing in the same school of medicine usually exercise in the same or similar localities under like circumstances, having regard to the advanced state of medical and surgical science at the time the physician discharges his legal duty to the patient. *Kuehnemann vs. Boyd (Wis.), 214 N.W.R. 326.*

Seventeen days after plaintiff's visit to the defendant, he had three X-ray pictures taken by Dr. Fortier, of Milwaukee. It is claimed that the injury results from the cumulative effect of the X-ray. The testimony shows that the ray applied in Dr. Fortier's office was merely for examination purposes, and not for treatment, and that it was applied on the front of his body, while the patient (plaintiff) was reclining. Mr. McIntosh testified in general that there is a possibility for an X-ray burn to appear on the back, where the ray is applied in the front, but that ordinarily the burn would make itself manifest at the point of application of the ray.

In this case it appeared that the itching sensation was manifested about two hours after the final treatment by the defendant, while ordinarily such a manifestation does not occur before 10 or 12 days thereafter. It continued for a long period thereafter, and became more aggravated as time went on. Furthermore, the redness of the skin appeared between four and five days after the visit to the defendant, and it appears that such a manifestation ordinarily does not appear before the expiration of from ten days to two weeks. This, in connection with the testimony of defendant's expert, McIntosh, that the burn ordinarily appears at the point where the X-ray enters the body, and the opinion evidence of Dr. Perry, plaintiff's expert, establishes the basis for a logical conclusion that the burn resulted from the negligent application of the X-ray by the defendant.

Defendant's counsel assign as error the giving by the court of the following instruction:

"You are instructed that the fact that a bad result following the treatment, if you find such was the fact from a consideration of all the credible evidence in the case, is not alone sufficient to charge the defendant with negligence. You are therefore not at liberty to conclude that the defendant was guilty of negligence or malpractice from the mere fact that bad results follow the treatment, *although that fact may be considered, together with all the other evidence, in reaching your conclusion.* The defendant cannot be held liable unless you are satisfied by a preponderance of all the credible evidence in the case, to a reasonable certainty, that he failed to use that skill and care which I have already mentioned and instructed you it was his duty and obligation to exercise in his treatment of the plaintiff and that such failure to exercise such care, if you find that he so failed, proximately caused injuries to the plaintiff."

That this instruction constituted error appears from the holdings of this court in the cases of *Kuehnemann vs. Boyd (Wis.), 214 N.W.R. 326,* and *Rost vs. Roberts, 180 Wis., 207, 192 N.W.R. 38.* We do not consider this case as a close one, and therefore conclude that the error is not prejudicial, under the provisions of the Statutes.

Error is also assigned upon the ground that the damages awarded are excessive. We have carefully reviewed the evidence, and in view of the actual loss of time, the seriousness of the injury, and the pain and suffering of the plaintiff, we are satisfied that the amount awarded is supported by the evidence.

OTHER CASES REPORTED

Slander of Physician (Amick vs. Montross (Iowa), 220 N.W.R. 51).—The plaintiff, a licensed physician, sued the defendant for slander. He alleged, among other things, that the defendant maliciously and untruthfully said to Dr. M. in the presence of Dr. S., "I heard Doc A. was drunk that night and wasn't able to go, was the reason

you were called." This statement was made, the plaintiff asserted, in connection with a confinement case, for the purpose of injuring his business and reputation. On motion of the defendant, the statement was withdrawn from consideration by the jury, on the theory that it was not actionable *per se* (that is, in and of itself and without proof of actual damage) and that on the entire record there was nothing, so far as this charge was concerned, to be submitted to the jury. From a decision in the trial court, the plaintiff appealed to the Supreme Court of Iowa. He contended that the language stated was actionable *per se,* because it charged him with drunkenness, and drunkenness was a crime, and also because the language was prejudicial to him in his profession. The Supreme Court concluded that, under the laws of Iowa, drunkenness was not such a crime as would make an allegation of drunkenness against a person actionable *per se.* The court held, however, that the language used by the defendant was prejudicial to the plaintiff in his profession and for that reason was actionable *per se.* It is true, said the Court, that the language used does not charge the plaintiff with any lack of professional knowledge or skill, or misconduct in the plaintiff's professional capacity, or any impropriety in treatment. It does charge, however, in substance, that at a time when a doctor was needed the plaintiff was drunk and unable to render medical service and attention. Said the Court:

A lawyer, a banker, a merchant, and men engaged in many other occupations have regular business hours. A physician's occupation differs therefrom. Sickness and accidents occur at any hour of the day or night. The emergency may happen at any minute, when the services of a doctor will be needed. The doctor is engaged in the practice of his profession every hour of the day. To say of a physician, in substance, that he was drunk and unable to attend upon a call, reflects upon his professional character. One would not be likely to call a doctor in case of sickness, accident, or emergency if there were any probable cause for believing that he would be found in a state of drunkenness. Such a charge "necessarily must, or presumably will as its natural and proximate consequence, occasion him pecuniary loss."

The Supreme Court held, therefore, that as there was sufficient evidence to prove the making of the statement complained of, the trial court was in error in withdrawing it from the jury.

The defendant pleaded in mitigation of the damages the general bad reputation of the plaintiff, as a physician and surgeon and doctor in the town of M——— and vicinity. Over the plaintiff's objection, he was allowed to introduce evidence to support this plea. The plaintiff, on appeal, contended that this was error, because the language complained of was uttered by the defendant, at N———E———, and the evidence adduced by the defendant should have been limited to evidence of the plaintiff's general reputation in that community. It appeared, however, that the distance between the two communities was only eight miles. The evidence received, said the court, was in exact conformity with the defendant's plea of mitigation and was properly admitted.

Because the trial court withdrew from the jury that count in the plaintiff's complaint based on the charge of drunkenness, the judgment of the court below was reversed and the cause remanded.

Ethics: Collusion between Physician and Lawyer Justifying Disbarment (In re Burke (N. Y.), 237 N.Y.S. 53).—In order to secure payment of his bills for professional services a physician recommended personal injury cases to a lawyer. Payment in such cases was contingent on the results. This arrangement violated the ethics of the legal and medical professions and was likely to lead to false testimony as to the nature of

the injuries. The lawyer was suspended from practice for two years.

Opinion Based on Absent Roentgenogram is Inadmissible as Evidence (People vs. Williams (Ill.), 169 N.E.R. 190).—In a prosecution for murder, a coroner's physician testified that he examined the body after death, that a roentgenogram showed that the bullet passed from the left to the right side of the body, shattering the ninth rib and the spinal cord, and that he viewed the body only and took the records from the hospital, but made no autopsy. He admitted that there was doubt as to the cause of death, but he stated that in his opinion death was due to heart disease, superinduced by nephritis, an infection of the kidneys, and an inflammation of the bladder, due primarily to the cutting of the spinal cord by the gunshot wound. No objection was made to the admission of this testimony when it was offered. On cross-examination, however, when the witness admitted that he had made no postmortem examination of the body and that he obtained his information as to the cause of death from the records of the hospital, counsel for the defendant moved to strike out his testimony with reference to the cause of death. The court did not rule directly on the motion but said that the witness might testify as to what he saw and remembered about the roentgenogram, which was "simply a physical thing." The roentgenogram was not introduced in evidence nor in any way identified, nor did the witness qualify as an expert in the reading of roentgenograms. The defendant was convicted and thereupon appealed to the Supreme Court of Illinois.

The testimony of the coroner's physician, said the Supreme Court, when given from the records of a hospital without proof of their authenticity, was clearly inadmissible, as hearsay, and should have been stricken out. His testimony concerning matters disclosed by the roentgenogram was likewise inadmissible, because no ground had been laid for such testimony. The rule in regard to the use of roentgenograms, when it is sought to put them in evidence, requires that the witness testify either that the roentgenogram shows accurately what the witness saw by examining the body through a fluoroscope, or that the witness is skilled in the use of the roentgen machine, that he took the roentgenogram concerning which he testifies, and that he is able to say that it is accurate. It was clearly error to permit the witness to testify, giving his conclusions as to what the roentgenogram showed, without proof of his qualifications and of the accuracy of the roentgenogram, and without accounting for failure to produce it. There was no proof of the cause of death, other than the testimony of this witness. As such proof rested on incompetent testimony, its admission was an error requiring the reversal of the judgment.

Workmen's Compensation Acts: Liability of Physician for Malpractice (McDonough vs. National Hospital Assn. (Ore.), 294 P. R. 351).—The Oregon workmen's compensation act provides that a workman injured in the course of his employment by the negligence or fault of a third party has a choice of remedies. He may proceed under the statute to obtain an award of compensation or he may proceed against the third party at common law, but he cannot do both. Having pursued one remedy, he is barred from subsequently invoking the other; if he elects to take under the act, he must assign his cause of action against the third party to the commission, for the benefit of the accident fund. An aggravation of the primary injury resulting from the mistake, negligence, or malpractice of a physician in treating the original injury is compensable under the act. Once having received and accepted compensation for the combined injuries, the employee cannot maintain an action against the physician for malpractice.

Libel: Report of Examining Physicians Appointed by Court (Mickens vs. Davis (Kan.), 294 P.R. 896).—The written report of physicians appointed by a court to make a physical examination of a party to an action in that court constitutes a privileged communication and cannot be made the basis for an action for damages for libel. In this case the plaintiff had obtained a judgment in the District Court of Douglas County against his employer under the workmen's compensation act of Kansas. Subsequently the District Court appointed the defendants, physicians and surgeons, to examine the plaintiff to determine whether his disability was still existing and whether it was permanent or partial. They were instructed to report the result of their examination to the court. The defendants reported, among other things, "that the cause of plaintiff's injury was a spinal lesion apparently due to syphilis, and that same was a progressive lesion, and that he, the plaintiff, would probably never be better than he is now."

Thereupon the plaintiff sued the defendants for libel. The Supreme Court of Kansas held that the report was privileged and that the plaintiff could not base an action for libel on it.

Chiropractic Treatment must be Limited to Manipulation (Heintze vs. New Jersey State Board of Medical Examiners (N. J.), 153 Atl.R. 253).—The appellant, Heintze, was licensed to practise chiropractic in New Jersey under Chapter 4, Laws of 1920, which apparently authorized chiropractors to treat human ailments by manipulation only.

Heintze, however, used a vibrator, an electric light, and the galvanic current. His assistant, in his presence, gave directions for a vegetarian diet and the use of flaxseed tea. "That such practice does not constitute the practice of chiropractic," said the Supreme Court of New Jersey, "but does constitute the practice of medicine and surgery, seems entirely plain." The Medical Practice Act of New Jersey is not unconstitutional because it provides for a trial without a jury of persons charged with practising medicine and surgery without licenses. The judgment of the trial court, convicting Heintze of practising medicine and surgery without a license, was affirmed.

Note.—Here is a fine decision for our New Jersey colleagues at least and for physiotherapists in general. *Diet, radiation, and electric treatment constitute the practice of medicine.*

—I. S. T.

CASE REPORTS AND NEW DEVICES

A CASE OF PULMONARY FIBROSIS OF OBSCURE ETIOLOGY, WITH BILATERAL SPONTANEOUS PNEUMOTHORAX[1]

By MAJOR ALBERT BOWEN, M.C., U. S. A.,
HONOLULU, T. H.

This is a rather unusual case which has considerable interest from the viewpoint of roentgen diagnosis and as a curiosity presenting multiple, bilateral, spontaneous pneumothoraces with absorption and apparent cessation of the latter.

The patient, C. S., aged 25 years, enlisted in the Army in March, 1925. For a short time he worked in an open stone quarry. In May, 1925, he began to have diarrhea with from 10 to 20 bloody stools a day, which has continued with slight occasional improvement up to the present. Soon after the onset of the colitis, he began to have pain in the chest, with productive cough and shortness of breath. In addition, he had pain and soreness in the lower abdomen, fever up to 102°, chills, with night sweats, and loss of weight. Later, he developed skin lesions which were shallow, indolent ulcers with much itching and secondary infection due to scratching. The patient was treated in the local station hospital before being sent to Walter Reed General Hospital for study and treatment.

Examination at the latter hospital showed a flat chest, with abdominal breathing, some dullness, and fine as well as coarse, moist râles over the entire chest persisting after coughing. The lower abdomen was tender. There were internal and external hemorrhoids.

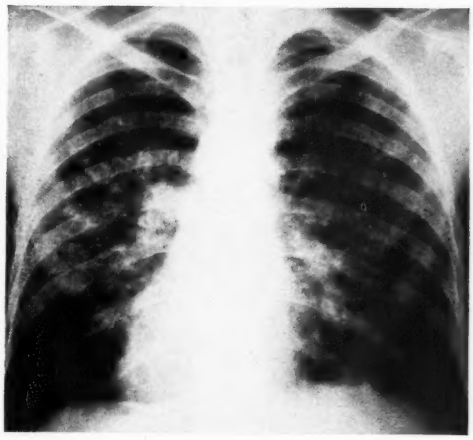

Fig. 1. Before pneumothorax, showing extensive interstitial fibrosis.

X-ray examination of the chest showed that in both lungs, from the first to the fifth ribs, anteriorly, there was a fine mottling, symmetrically distributed. Linear markings were thickened and the hilus shadows were prominent. The impression was of probable pneumonoconiosis, with tuberculosis to be considered. The gastro-intestinal series was essentially negative.

Sigmoidoscopic examination showed many superficial ulcers, with submucosal hemorrhages extending down to the rectum. Diagnosis was ulcerative colitis.

Sinus examination showed positive maxillary antra, which were treated. There was much dental work done to clean up the mouth and the tonsils were removed. Examinations for tubercle bacilli and parasites were consistently negative.

The patient showed some improvement and gained ten pounds during a stay of fourteen months at Walter Reed Hospital. Among the many things tried he was treat-

[1]Published with the consent of the Surgeon General of the Army, who assumes no responsibility for any statements contained therein.

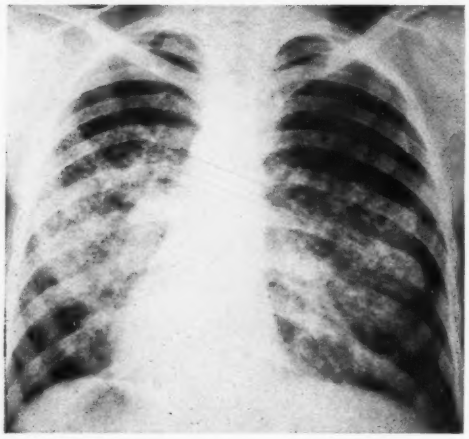

Fig. 2. After spontaneous pneumothorax on the right side.

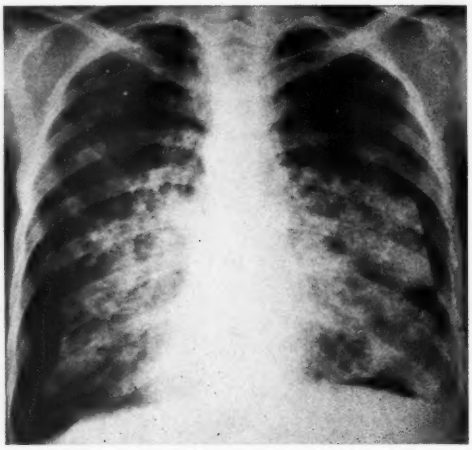

Fig. 3. Bilateral pneumothorax, more extensive on the left side.

ed by emetin and vaccines, but no form of treatment helped very much.

He was discharged from the Army for disability, later going to the Soldiers' Home Hospital. In 1928, he went to New Mexico, where he tried to work, but, becoming worse again, he returned to the Soldiers' Home.

In November, 1930, he was transferred to Fitzsimons General Hospital for observation for tuberculous enteritis. On admission, the patient was having from ten to fifteen bowel movements a day, some pain in the chest, but no cough or sputum. At this time, the fingers were clubbed, there were healing furuncles on the right shoulder, and the chest had râles and increased dullness to percussion. X-ray examination (Fig. 1) showed very heavy, bilateral, interstitial fibrosis, with some emphysema at the peripheries. Laboratory studies from stools, sputum, and scrapings from ulcers were negative for tuberculosis, fungi, and parasites. A course of potassium iodide produced no change in the patient's condition.

On Jan. 15, 1931, the patient had sudden pain in the right chest with a feeling of fullness, but not much embarrassment. X-ray examination showed a moderate pneumothorax on the right side, with emphysematous blebs on the periphery. It was believed that a bleb had ruptured and that the fibrosed lung had prevented complete collapse (Fig. 2). February 5, following a severe coughing spell, the patient had pain in the left chest, cyanosis, and shortness of breath. Three hundred c.c. of air were drawn off. X-ray examination showed bilateral pneumothorax (Fig. 3). On February 17, there was another similar attack on the right side, and X-ray films showed an increase in the pneumothorax. At this time, 200 c.c. of air were withdrawn. On March 3, there was sharp sudden pain on the left side, with dyspnea and cyanosis. X-ray examination showed an increase of air in the left lung. X-ray films made on March 8 showed some fluid and pleurisy on the left side. On March 22, there was acute pain in the left chest, respiratory embarrassment, heart to right. One thousand c.c. of air were withdrawn. Another spontaneous pneumothorax occurred on the right side on April 3, but with fewer symptoms. Spon-

taneous pneumothorax occurred on the left side on April 28, accompanied by less severe symptoms.

That the patient did not develop empyema with these many lung ruptures is probably due to the fact that the ruptures were at the extreme periphery, distant from large bronchi.

The emphysematous blebs contained little or no fluid and did not discharge infected material into the pleura. Although the blebs collapsed, the point of rupture remained like a valve and probably continued to force air into the pleura for several days, when there was coughing or forced inspiration. This may account for the delay in absorption of the air.

Later chest examinations showed the air being absorbed in both sides, with considerable pleural reaction. Both lungs gradually re-expanded and the patient has since had no more spontaneous pneumothoraces. It is believed that generalized pleural adhesions formed which hold the lung to the parietal pleura and prevent rupture of the blebs and collapse. The fibrosis has gradually increased.

Repeated microscopic and cultural studies of scrapings from ulcers on skin and sigmoid and of sputum continued to be negative except for two different fungous growths which were believed to be air contaminations.

On Sept. 16, 1931, the patient left the hospital, his condition not much changed from that found on admission. The diagnosis was: (1) Colitis, chronic, ulcerative, cause undetermined; (2) Interstitial fibrosis of both lungs, cause undetermined; (3) Multiple, spontaneous, bilateral pneumothorax, due to the fibrosis.

We shall be glad to receive comments on the etiology from any who have had similar cases. Our impression is that it is of mycotic origin in spite of the continued negative findings.

THE RADIOGRAPHIC DETECTION OF THE CATFISH SPUR AS A FOREIGN BODY

By ROBERT B. TAFT, M.D., B.S.,
CHARLESTON, S. C.

Some time ago I was asked to attempt the radiographic determination of a foreign body of a rather unusual nature. This foreign body was supposed to have been the spur of a catfish.[1] Being unfamiliar with the composition of this spur, I secured one and was rather surprised to find it dense enough to cast an excellent shadow through the flesh or bones of a man's foot. As the wounds from this fish are of frequent occurrence in this region, I felt that the matter might be of some interest.

The catfish is often caught by those who fish along the beaches of the South Carolina coast and since it is not regarded as edible except by the colored people, it is felt to be a nuisance and is left to die on the shore, where it is frequently stepped upon. The

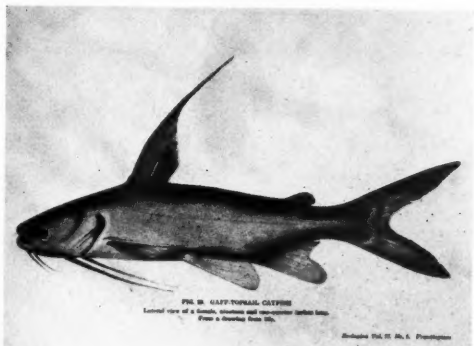

Fig. 1. The sea catfish, copied from an illustration by Gruder, "Zoologica," Vol. II, No. 5.

[1]This is a summary of the article which appeared in "Zoologica," August, 1916, "The Gaff-Topsail: A Sea Catfish that Carries its Eggs in its Mouth":

The Gaff-Topsail Catfish *(Felichthys felis)* is a subtropical form ranging as far north as Cape Cod but is especially common along the coasts of Florida and the Indian River. From Thomas Ash's "Carolina" comes the following description of it: "Catfish, whose head and glaring eyes resemble a Cat; it's esteem'd a very good fish, it hath a sharp thorny Bone on its Back, which strikes at such as endeavor to take it; which by seamen is held venemous." The male incubates the eggs in his mouth not only until they are hatched but until the young are able to take care of themselves. The largest number taken from the mouth of one male was 55.

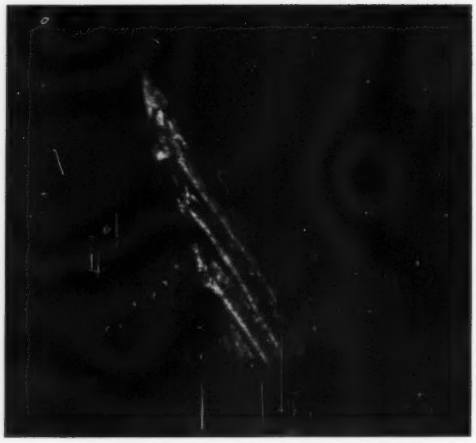

Fig. 2. The spur of the catfish magnified about 20 diameters.

Fig. 3. The spur superimposed on an adult foot, showing the density. The actual fragment reported in this paper is too small to permit of reproduction in an illustration.

spur (Figs. 1 and 2) has a number of barbs which make it very difficult of withdrawal from the wound and there is some chance that small fragments may be broken off. While it is commonly believed that the slime from this fish is poisonous, there is no real foundation to that idea; but at least the wound gives pain out of all proportion to a clean wound.

In this particular instance a woman stepped on a catfish which had been recently caught. The spur penetrated through the sole of her shoe, obliquely through the second toe, and into the great toe. The spur was examined by some one in the party and pronounced whole but it is doubtful if the examination was very carefully made.

For about five days the patient was able to walk, but with difficulty, following which the pain became so severe that she had to remain in bed for a week. Discharge continued from the wound for about one month.

A radiographic examination made about two weeks after the injury showed a minute foreign body in the soft tissue of the great toe, just medial to the base of the proximal phalanx. This body, which was triangular in shape, was seen in the same position on five films of different densities. It seems reasonable to believe that this was the point of the spur. No attempt was made to remove the fragment, as it could hardly have been found. Another series of films made two months later showed that it had disappeared, either by discharge from the wound or absorption. This piece of spur was so small that it could not be reproduced in a magazine illustration, so a similar spur was procured, placed beneath a foot, and a test film made. This spur, which is shown in Figure 3, is seen to be quite dense, showing well through the metatarsal bones.

This case is reported because, so far as I know, no mention has been made of a similar one in any previous writings.

I am indebted to Mr. E. Milby Burton, Acting Director of the Charleston Museum, for the information about this fish.

LYMPHOBLASTOMA AND TEMPERATURE IN IRRADIATED PATIENTS

By JAMES R. GEMMILL, M.D.,
MONESSEN, PENNSYLVANIA

The following is a study of patients having lymphoblastoma who were admitted to

the Massachusetts General Hospital for irradiation. The effect of irradiation upon the temperature is noted and what part the enlarged liver, when present, contributes toward increased temperature. This study

The temperature range showed no relation to the amount of involvement, being high in cases with but one group of nodules and evidencing a moderate increase, or none, when the glands showed marked extension

Massachusetts General Hospital

NAME E. R.

DISEASE Lymphoblastoma DATE May 24

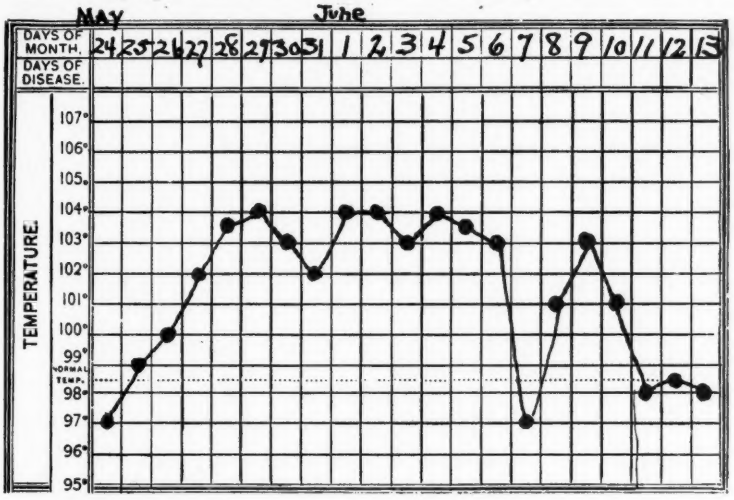

Chart I. Temperature range during the time in which the patient was not subjected to irradiation.

comprises a group of 73 cases of lymphoblastoma, all of which were proved by biopsy.

Rise in temperature in lymphoblastoma is thought to be due to areas of necrosis which have been observed at autopsy in the glands affected, though many cases having high temperature during the course of the disease and coming to autopsy show no necrosis. The areas involved as shown clinically were the cervical, axillary, and inguinal lymph nodes, the spleen, and the liver. In some patients but one group of glands was affected; others showed two or more affected groups at the same time.

of the process. The temperature curve was notably out of proportion to the physical findings. In cases which showed enlargement of the liver the reaction of the temperature was identical with involvement elsewhere. Irradiation with high voltage X-ray was given over the areas involved by the process, the dose being calculated as suitable for the individual and producing improvement in the condition present. Temperature of varying heights was noted at the beginning of the application of irradiation, showing no reaction with relation to the time or number of treatments though the patients improved both physically and

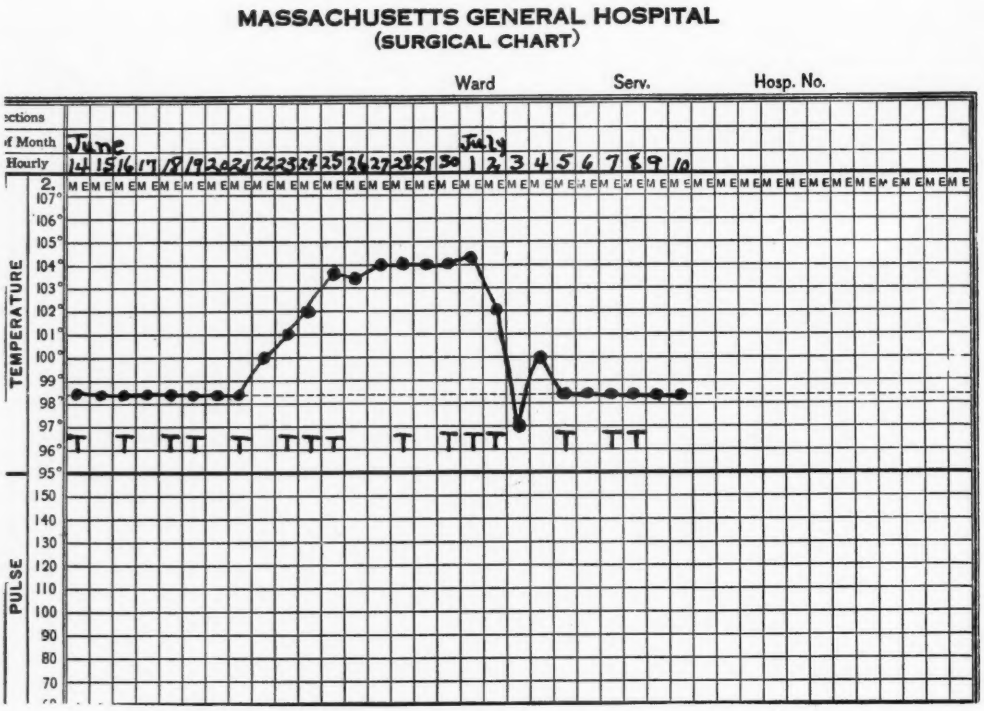

Chart II. Temperature range during X-ray treatment. "T" indicates days on which the treatment was given.

TABLE I
Temperature

Types		Pel-Ebstein	Prolonged	Slight or None
Lymphoblastoma	(21)	4	10	7
Pseudoleukemia	(25)	5	10	10
Lymphoblast	(21)	3	8	10
Lymphosarcoma	(6)	0	0	6

clinically. A few patients showed a reaction to the effect of the X-rays immediately after treatment, evidenced by nausea and chilling. The temperature remained unchanged.

Baldridge and Awe,[1] in their studies of the incidence of temperature in lymphoma, grouped their cases according to the histologic picture and types of temperature. In a similar manner I have grouped the cases of lymphoblastoma (Table I).

Pel-Ebstein is the name given to a remittent and intermittent type of temperature which rises and remains high for from three to thirty days, and does not show a septic character. The following is a case of this type showing the course of temperature prior to irradiation and the absence of reaction to its effect.

Case 1. A housemaid, single, white, native-born, aged 28 years, entered the hospital complaining of swollen glands on both sides of the neck. Her history included influenza, followed by pneumonia twelve years previous to the present examination, tonsillectomy, and adenoidectomy eight months previous to the present exam-

[1] C. W. Baldridge and C. D. Awe: Arch. Int. Med., February, 1930, XLV, 161-190.

ination, after several attacks of severe sore throat. For a year and a half the patient had noted a feeling of weakness, with gradual loss of weight and alternate swelling and recession of the glands in the neck, the condition being more marked during the seven months preceding examination, accompanied by rise of temperature from 101 to 102 degrees F.

Physical examination showed the cervical glands to be the size of marbles, the spleen palpable, and a palpable mass present near the iliac crest on the right side.

The X-ray examination showed the hilus shadows on both sides to be increased in width and density, with sharply lobulated borders.

The patient was admitted on May 24, 1930. The temperature range from the day of admission until June 11, 1930, during which time she was not subjected to irradiation, is shown on Chart I. On June 14, treatment by irradiation was instituted, the areas treated being the right and left side of the neck, spleen, and anterior and posterior chest. Approximately 525 r units of high voltage X-ray were given over each area in divided doses.

DISCUSSION

All the patients included in this study were admitted to the Massachusetts General Hospital during the period from 1925 to 1931.

Only those cases proved by biopsy to be lymphoblastoma are included in the group.

All the patients received high voltage X-ray treatment while in the hospital and showed improvement to some degree, either symptomatically or clinically.

The temperature curve failed to show any change concomitant with the changes in the involved areas or the application of irradiation.

CONCLUSIONS

1. Irradiation exerts a beneficial influence upon the process of lymphoblastoma although it fails to bring about any change in the various types of pyrexia.

2. The enlargement and recession of the liver and the rise and decline of temperature pursue courses, each without relation to the other, and they are not dependent upon the changes in the general progress of the disease.

ANOMALY OF THE HEPATIC FLEXURE OF THE COLON: REPORT OF CASE

By W. WALTER WASSON, M.D., and JOHN S. BOUSLOG, M.D., DENVER

Anomalies of the hepatic flexure of the colon are not as common as the wealth of literature on the subject would lead one to expect. The one which we wish to present is of a kind recognized by various names, but most descriptively termed (by the Continental authors) "hepato-diaphragmatic interposition of the colon" (1, 2, and 7).

There is a type of redundant colon which shows this same interposition of the colon between the diaphragm and the liver, and which may be permanent or temporary (2, 3). Whether the condition is due to increased length and consequent overlapping or just to malposition, it is undoubtedly anomalous. The etiology is to be found in defective embryological development (2).

The condition was first described roentgenographically in 1899 by Béclère (4), and quoted by Trémolières and Pierron (7) and Just (2), but Curschmann (5) described it fully in 1894 in his classic monograph on the subject. In 1920, Swezey and Black (6) reported a similar case which was detected by one of us in the diagnosis of routine chest roentgenograms. At that time, only one other case could be found. A review of the

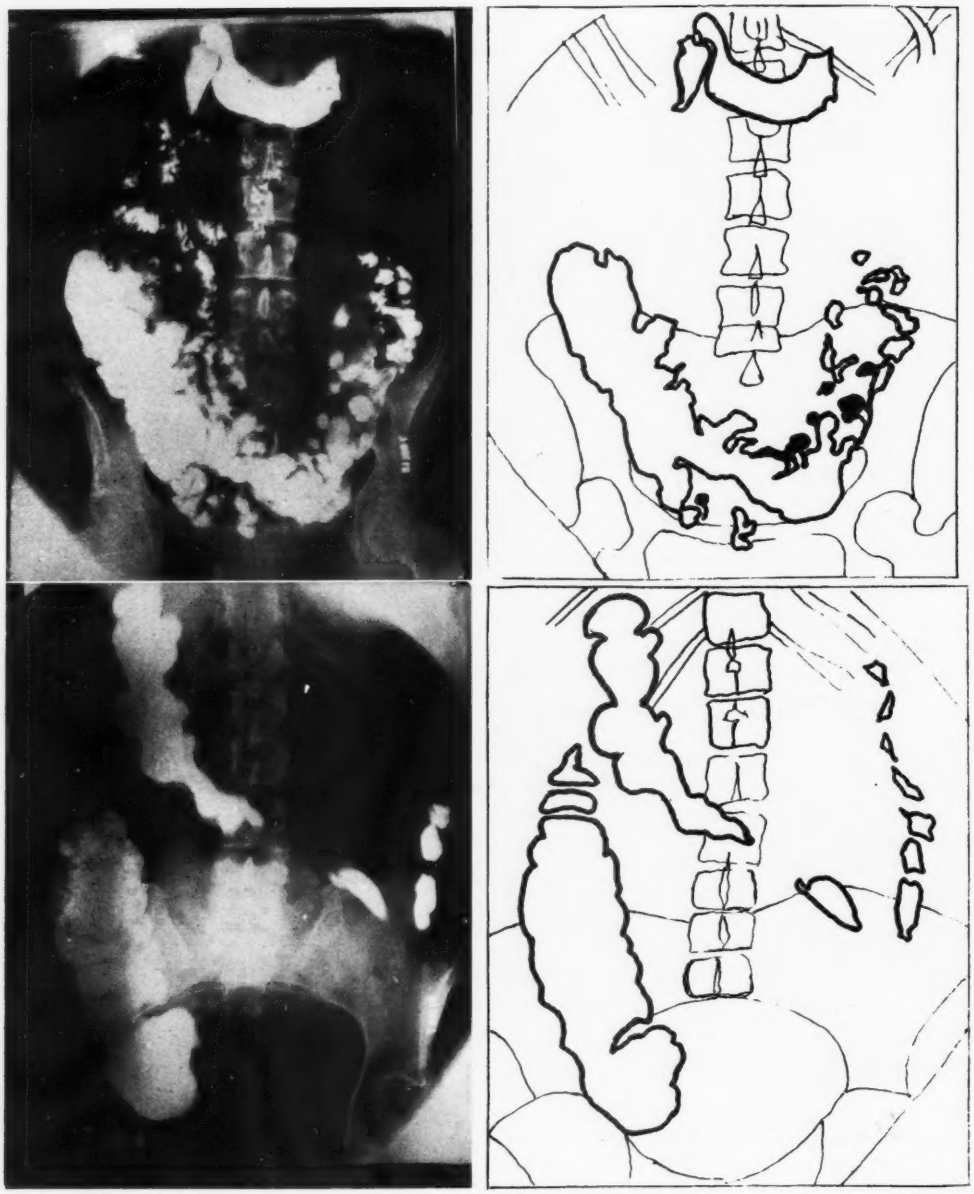

Fig. 1-*A (upper left).* Roentgenogram at 6-hour interval. Note unusual position of a well filled duodenal cap.

Fig. 1-*B (upper right).* Pen sketch of condition portrayed in Figure 1-*A.*

Fig. 2-*A (lower left).* Roentgenogram at 24-hour interval. Note large club-shaped cecum lying low in the pelvis. Hepatic curvature not seen and could easily have been overlooked.

Fig. 2-*B (lower right).* Pen sketch of condition portrayed in Figure 2-*A.*

literature since that date has revealed only a few more such cases. Two were reported by Trémolières and Pierron (7), but neither one was diagnosed until operation. Just (2) re-

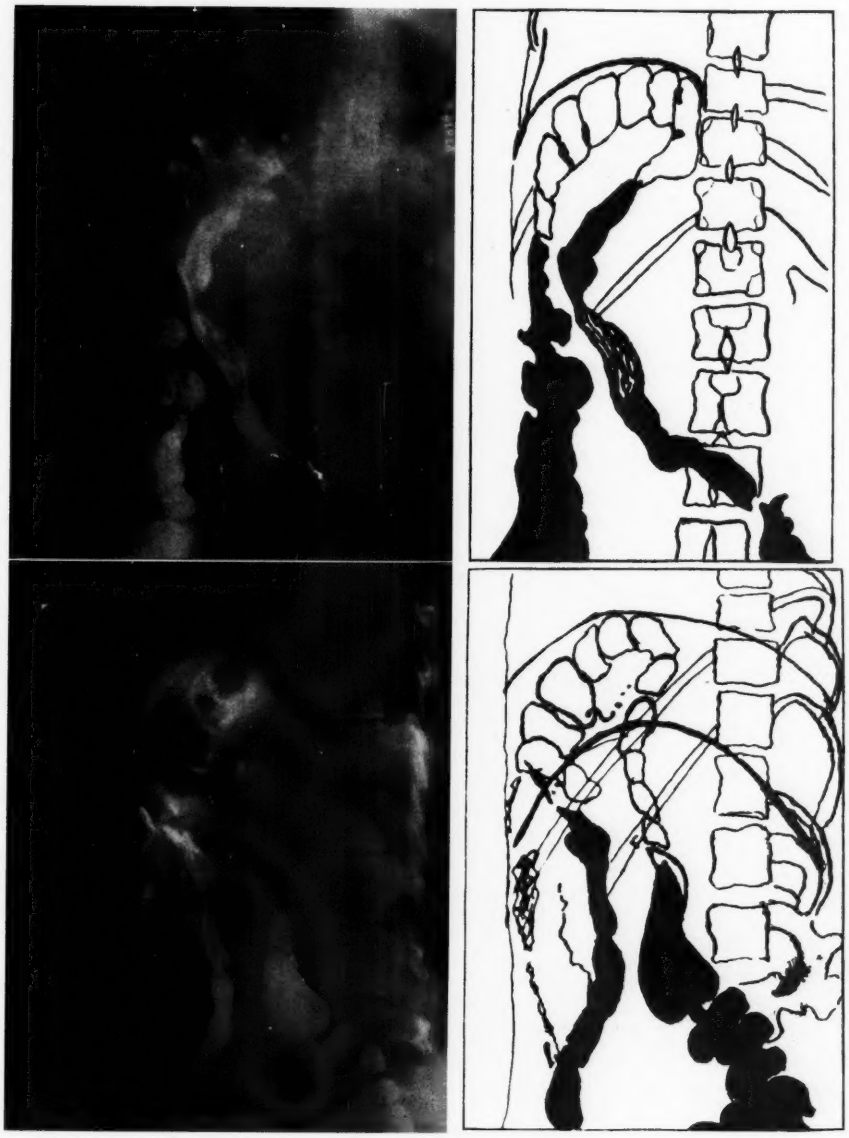

Fig. 3-*A (upper left)*. Roentgenogram at 24-hour interval, antero-posterior position. Gas-filled hepatic flexure lies directly beneath the right diaphragm.
Fig. 3-*B (upper right)*. Pen sketch corresponding to Figure 3-*A*.
Fig. 4-*A (lower left)*. Same as Figure 3-A, except that the view in this instance is lateral, showing that the gas-filled hepatic flexure passes over the liver and beneath the right diaphragm.
Fig. 4-*B (lower right)*. Pen sketch corresponding to Figure 4-*A*.

ports three more cases, one permanent and two temporary. There have perhaps been three cases analogous to ours which have been reported since 1920.

Most authors agree that the therapy should follow the same lines as that for visceroptosis, and that surgical relief is to be considered only as a last resort.

CASE REPORT

Mrs. E. W., white, widow, aged 57 years, was referred to us for gastro-intestinal examination, in February, 1930. She complained of pain in the right upper quadrant, and was annoyed by gas and constipation. The latter responded to laxatives.

Previous History.—She had had an appendectomy twenty-five years previous to the present examination. Two years after the appendectomy she passed some kidney stones, had a bladder infection, and was operated upon for a kidney suspension. She also had had an operation for some uterine disorder.

Six or seven years before she was referred to us, she began to have pain in the right side of the abdomen, gas, constipation, pain and indigestion associated with meals.

Present Condition.—The patient was a tall, flabby looking woman, whose average weight was 128 pounds. Her general condition seemed fair. She was especially tender over the right abdomen, but no mass was palpable.

Roentgen Examination.—Roentgenographically, we found that the gall bladder filled and emptied well. The stomach was poor in tone, and emptied in 6 hours. The pylorus was negative, the duodenum swung to the right, and the first portion turned downward. This was a most unusual position, but there was no definite pathology revealed. The small intestine swung well toward the region of the gall bladder, but there was no obstruction. The cecum was low and large. The hepatic flexure lay beneath the diaphragm, and there was considerable stasis. The roentgen diagnosis was: anomaly of the hepatic flexure of the colon, with probable adhesions in the region of the liver, but without any obstruction.

COMMENT

This case of anomaly of the hepatic flexure of the colon is important in that the anomaly was an interposition of the colon between the liver and the diaphragm. There was considerable stasis of the colon, with toxic symptoms. The inverted position of the duodenum was also unusual. The value of the roentgenographic examination lay in that it demonstrated the fallacy of considering operation to relieve the bowel condition in the right lower quadrant.

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UTERINE INTUBATOR, A NEW TYPE FORCEPS

By HYMAN I. TEPERSON, M.D., Attending Radiation Therapist, Brownsville and East New York Hospital; Associate Radiation Therapist, Brooklyn Cancer Institute (Ira I. Kaplan, M.D., Director), Brooklyn, New York

Although radium tubes have been used extensively in the treatment of such gyneco-

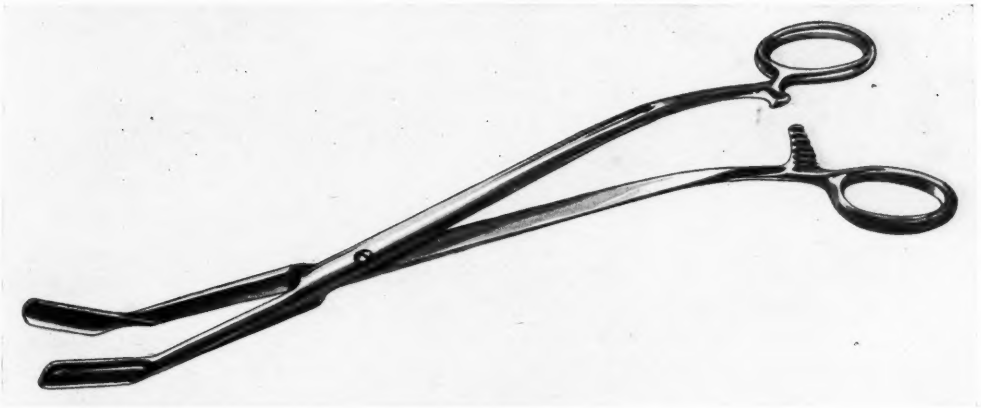

Fig. 1. Uterine intubator. The general shape conforms to that of the Bozeman type forceps. The small blades are grooved and form an angle of 30 degrees with the shaft.

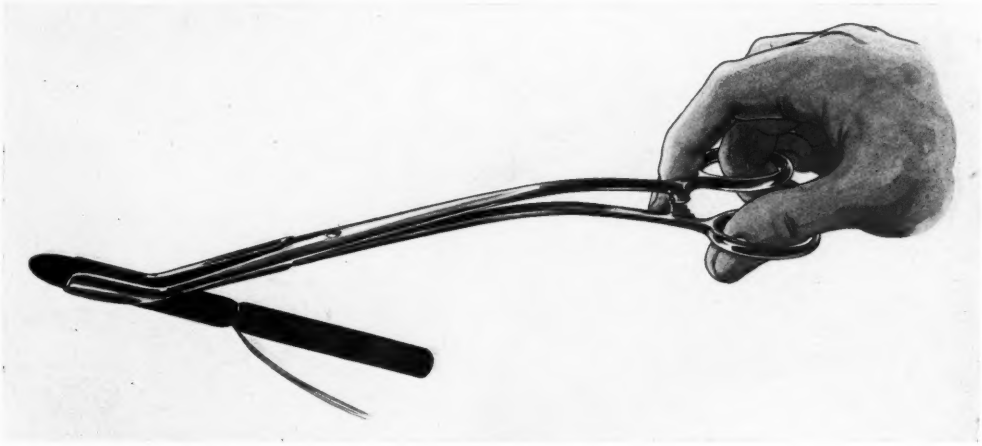

Fig. 2. Forceps holding a rubber sound, such as is generally employed in cases of carcinoma of the cervix and uterus, containing several tubes of radium.

logic conditions as malignancy of the cervix and uterus and the benign metrorrhagias, there has not, until now, appeared any specially contrived instrument to facilitate the handling and insertion of these tubes in the uterine canal. Workers with radium have long felt the need of a forceps so constructed that cylindrical tubes, either of metal or rubber, may be readily picked up, firmly grasped, and easily directed into the cervical or uterine canal. Heretofore, the ordinary curved dressing, straight billed, or placental forceps were employed for this purpose, but none of these held the radium tubes firmly or prevented slipping or rotation, especially when a lubricant had been used on the tube. Moreover, in those cases in which fixation of the cervix is marked,

insertion of a rubber sound containing two or more radium tubes is difficult with the ordinary forceps now generally used, as a slight resistance to the tube causes it to bend and rotate out of the forceps and to leave its position in the canal, often necessitating readjustment of the tube with the unprotected hand.

A new type forceps designated as a uterine intubator has, therefore, been devised which avoids the difficulties mentioned. It has the shape of a double curved uterine dilator, with finger eyelets at one end and a pair of small blades at the other end. These blades are one inch long and cylindrical in shape, forming a 3/8-inch circular arc and making an angle of 30 degrees with the shaft of the forceps. The inner surfaces are grooved lengthwise. The blades are large enough to handle all types of radium tubes, and thin enough to render additional dilatation of the cervix unnecessary while the radium tube is being inserted. When the tube is grasped by the blades of the forceps, it is automatically adjusted in place by the ordinary finger pressure on the forceps handles. This factor becomes especially helpful when the physician is using large rubber sounds which must be gradually pushed into the canal by several to-and-fro movements.

In using the Kaplan colpostat for the treatment of malignancy of the cervix, the rubber corks are usually inserted by hand. This new type forceps readily grasps these rubber cylindrical applicators and makes their placement in the vagina safe and easy.

The small capsule radium applicator, ordinarily employed in the treatment of metrorrhagias, occasionally gets lost in the uterine canal, due to the breaking of the at-

Fig. 1. Left to right—patient, output divider, super-power diathermy machine, with nurse at control, and patient. This shows the double treatment set-up.

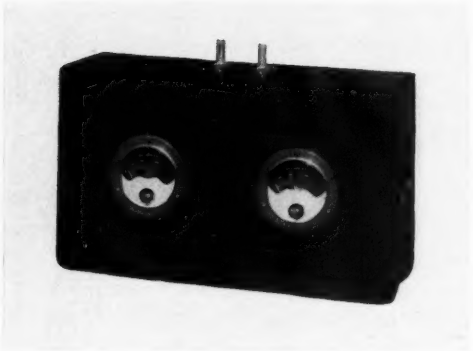

Fig. 2. Output divider. Note the two milliamperemeters and two resister levers.

tached string. This new type forceps makes the retrieving of the radium tube easy. The forceps grasps the tube readily, prevents its slipping or rotating out of the axis of the canal, and renders easy its withdrawal through the internal os.

SUMMARY

1. A new forceps is described which facilitates the introduction of tubes into the cervical and uterine canals.
2. This forceps can be used for inserting the Kaplan colpostat and cork in the vagina.
3. It may also be used as an extractor for tubes "lost" in the intra-uterine canal.
4. The name "uterine intubator" suggests the purpose of this new forceps.

THE SUPER-POWER DIATHERMY MACHINE WITH AN "OUTPUT DIVIDER"

By J. F. HAMILTON, M.D., Willis C. Campbell Clinic, MEMPHIS, TENN.

Our particular purpose is to call the attention of the profession to this new device, the output divider, in the practical application of the super-power diathermy machine. Photographs of all apparatus, including its application to the treatment of one case at a time, have already been published,[1] but for the sake of simplicity and clearness it is thought advisable again to present photographs of the integral parts of the diathermy set-up, including the new output divider, showing two patients under treatment.

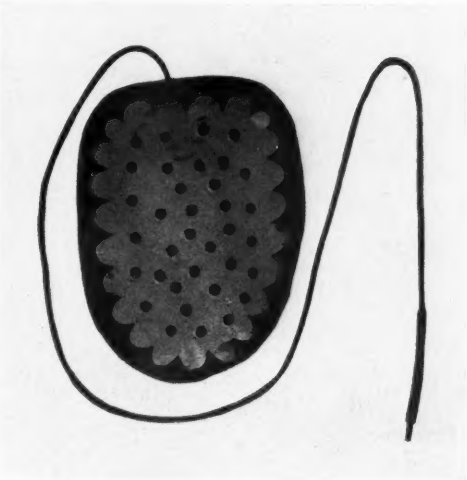

Fig. 3. Front electrode accommodates not more than 4,000 milliamperes (16.5 × 11 inches).

It was found that, when one has a number of patients to treat by means of elevation of general body temperature with the new diathermy machine, the cost of the individual treatments and the length of time required to administer a single treatment were prohibitive for many patients. It was due to the ingenuity and electrical knowledge of Mr. H. D. Roop and Mr. T. T. Magnuson, and their personal knowledge of the complicating factors, such as the giving of one treatment at a time, that the output divider was devised. This apparatus has permitted us to treat two patients simultaneously and, therefore, has resulted in a

[1] C. A. Neymann and S. L. Osborne: Jour. Am. Med. Assn., Jan. 3, 1931, XCVI, 7-13.

Fig. 4. Back electrode (16 × 10.75 inches).

great saving in time and expense to the patient. We have given about twenty-eight double treatments up to this time, using the new device, and so far it has proved satisfactory with one exception, when the two patients complained simultaneously of getting a shock at the moment the machine was turned on. Of course, the current was immediately cut off. The divider was examined, a short circuit strap installed, and since then not the slightest shock has been experienced.

The output divider consists of a pair of milliamperemeters and a pair of variable resisters, the whole constituting an accessory control which is inserted into the output circuit of the super-power machine.[2]

The electric circuit of the output divider is so arranged that when it is in use two patients are connected in parallel across the

[2]H. D. Roop and T. T. Magnuson: Personal communication.

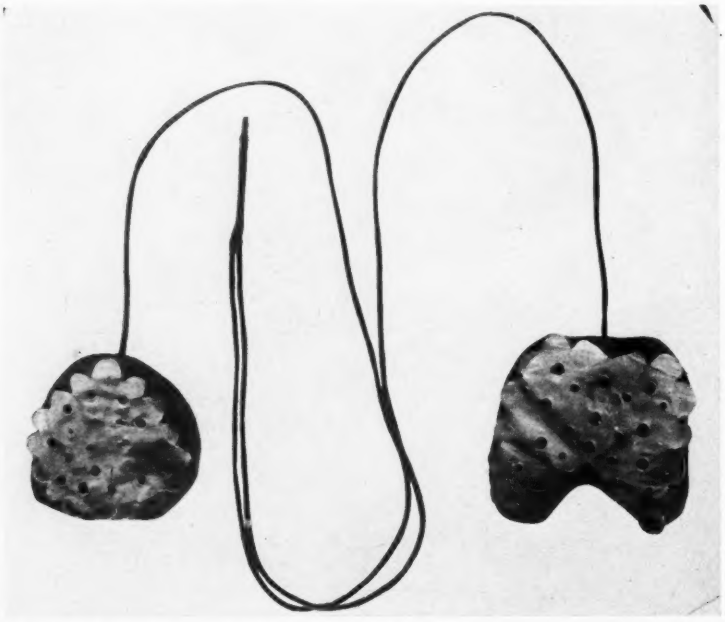

Fig. 5. Double front electrodes which are used when more than 4,000 ma. are given. Larger 11.0 × 6.5 inches (center), smaller 9.5 × 8.75 inches (center).

output of the diathermy equipment, each patient, however, being in series with the milliamperemeter and variable resister. The operator can thus not only accurately divide the total output between the two patients but has the means of observing the amount of current each patient receives.

We have found that around 8,000 ma. is all that can be obtained from the machine when two patients are treated with only the standard number of electrodes being applied. It is said, however, that the full 10,000 ma. could be utilized, if more electrodes were inserted in the circuit. This has not been necessary, as, with only 3,500 ma., we have been able to obtain 104° F. in one and a quarter hour.

The material we are using as electrodes is somewhat different from what was originally used, in that the electrode foil is about 0.2 mm. thick, which, in turn, is about one-fifth as thick as that originally used. This thinner material conforms more closely to the contour of the body and is naturally much lighter than the thicker variety. The configurations made into the original electrodes are not incorporated in the thin plates for two reasons: first, we have not found it to be necessary; second, the thinness of the material will not permit so much to be cut away. Our electrodes are made here in the Clinic.

AN X-RAY BOARD FOR OBTAINING ROENTGENOGRAMS OF ANIMALS IN THE HORIZONTAL AND UPRIGHT POSITIONS

By ALTON OCHSNER, M.D., and I. M. GAGE, M.D.

Department of Surgery, Tulane University School of Medicine, New Orleans, Louisiana

The need for a suitable contrivance for obtaining roentgenograms of experimental animals in various positions is apparent. The ordinary clinical roentgenographic table

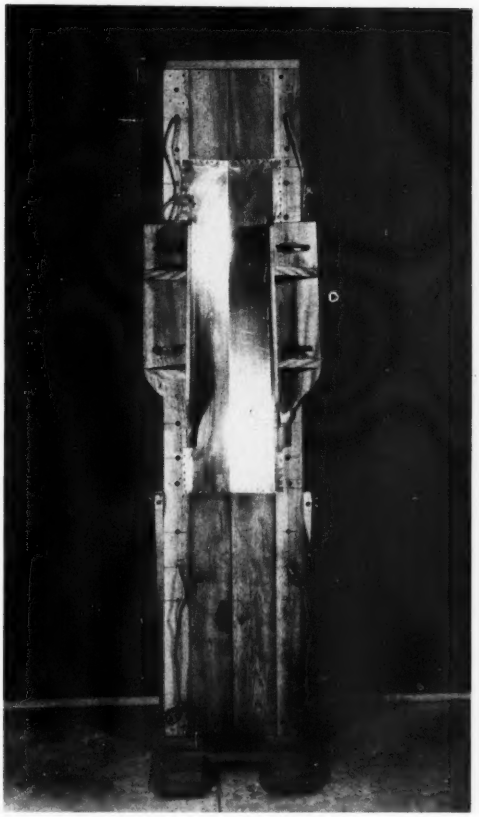

Fig. 1. Anterior view of table in the upright position, showing the side boards which are adjustable from side to side and also from end to end.

is practically of no value for use in roentgenography in animals. By means of a board described by Stewart,[1] satisfactory roentgenograms can be obtained in the horizontal position. However, considerable difficulty is encountered in obtaining roentgenograms in positions other than the horizontal.

In the experimental laboratory, as well as in the clinic, the desirability of obtaining roentgenograms, especially in the upright position, is at once apparent, especially in experiments involving the thoracic viscera in which the possibility of the occurrence of

[1]H. J. Stewart: A Technic for Measuring X-ray Photographs of the Cardiac Areas of Dogs. Jour. Clin. Invest., 1927, III, 475.

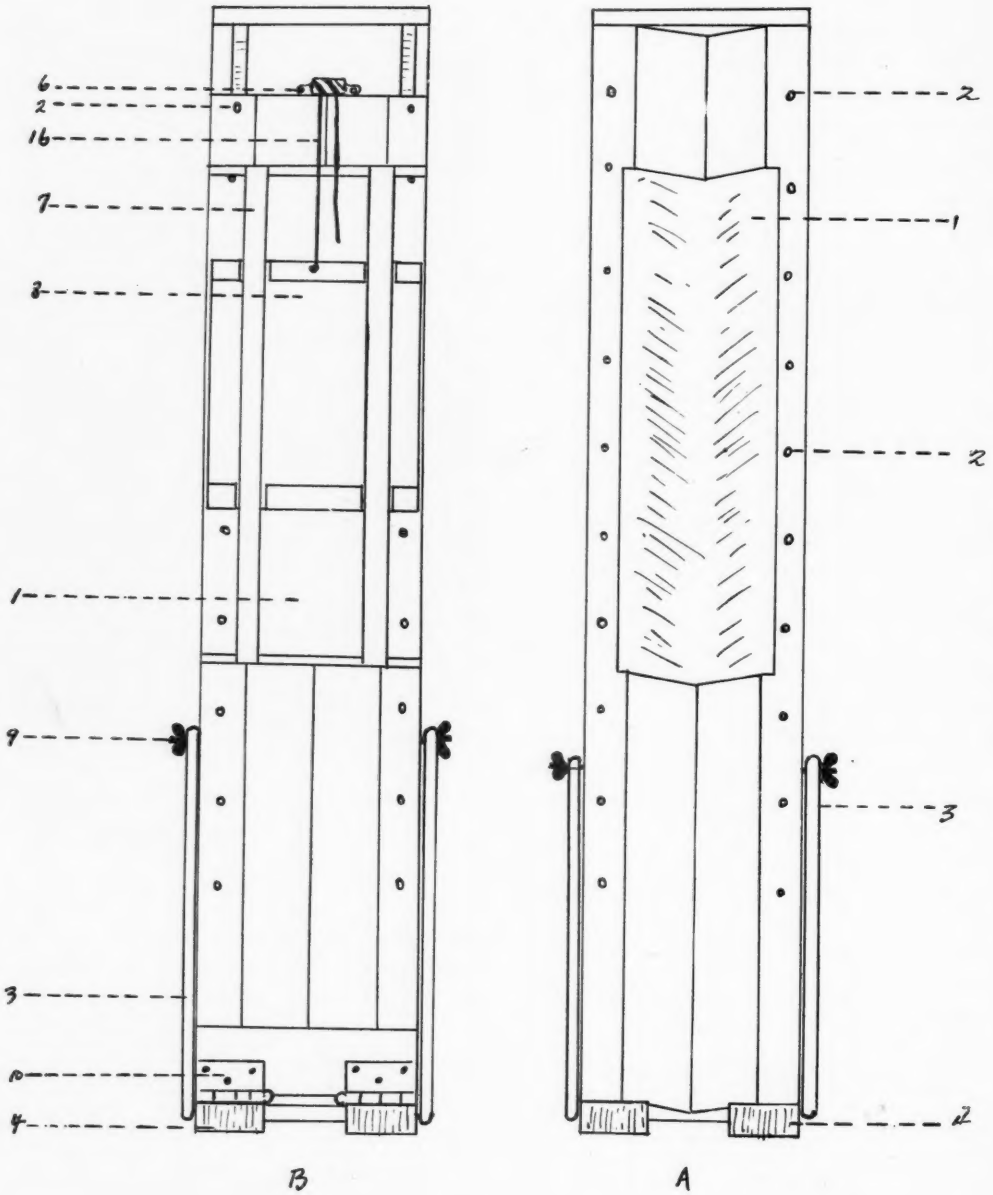

Diagram I. Diagram of front and rear views of board drawn according to scale. Key to Diagrams I, II, III: 1. Aluminum plate. 2. Hole in board through which thumb screws holding sidepieces are introduced. 3. Brace supporting board. 4. Base. 5. Crosspieces connecting two side pieces of base. 6. "Lock" pulley for rope suspending plate carrier. 7. Track for plate carrier. 8. Plate carrier. 9. Adjustable thumb screw for side braces. 10. Hinge connecting base and board. 11. Support for side board. 12. Adjustable thumb screw supporting side board. 13. Upright portion of side board. 14. Base of side board. 15. Opening in base of side board, making side board adjustable. 16. Cross-arm of board, showing curvature in center portion of board.

pleural effusion exists. Roentgen examinations of the gastro-intestinal tract also are facilitated with the animal in the upright position, because no pressure is exerted on the intestine by the vertebral column.

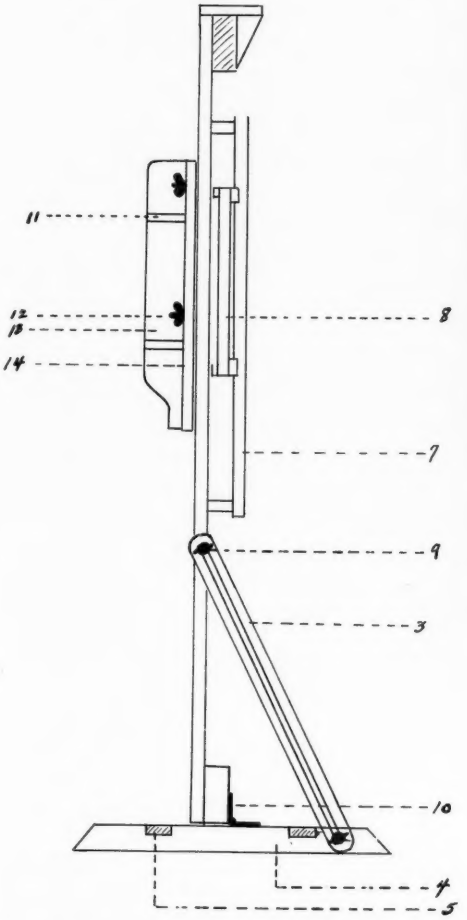

Diagram II. Diagram illustrating side view of the board.

In order to obtain roentgenograms of the various portions of the body with the animal in different positions, a modification of the Stewart board was constructed (Figs. 1, 2, 3, and 4). The board is made in such a way that roentgenograms can be taken in the horizontal, upright, or intermediary positions between the horizontal or the upright without changing the animal on the board.

Fig. 2. Posterior view of board in the upright position, showing the braces extending from the board down to the base. The plate carrier, which is adjustable, *i.e.*, can be raised or lowered to suit the particular region and animal, is illustrated.

The board proper is composed of ¾-inch lumber. On either side a piece 2½ inches wide by 5 feet long extends the entire length of the board. At each end a 2×4, 12½ inches long, is used to connect the two side pieces mentioned above. The center 8½ inches of the 2×4's is beveled in such a way that at the center the greatest depth measures six-eighths of an inch. This is so done that a trough-like depression is pro-

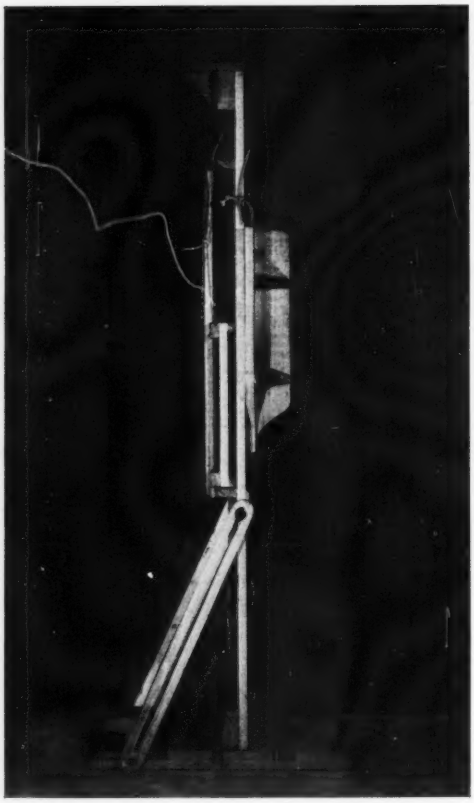

Fig. 3. Side view of table, showing position of plate carrier and the relation of the braces to the board and the base.

of the board. This area is covered by an aluminum plate, 9¼ inches wide by 30 inches long, which is nailed on either side to

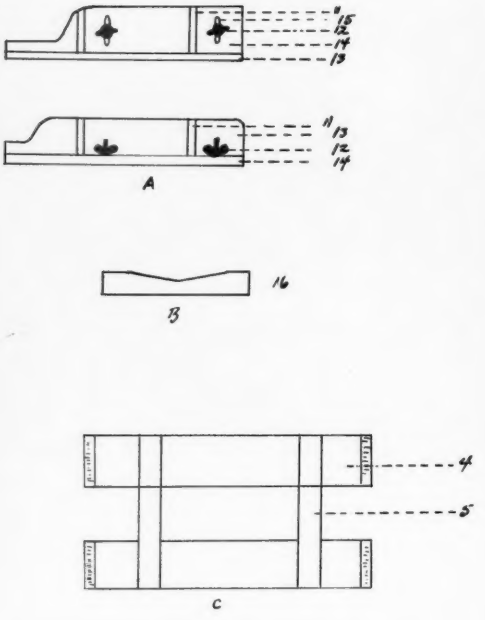

Diagram III. Diagram illustrating the component parts of the board, showing construction. A. Side board. B. Cross members for the board proper. C. Base.

duced in the center of the board. Two pieces of 1 × 2, 12½ inches in length, are similarly beveled. They are placed on the bottom of the board, the one, 8 inches from the upper end and the other, 24 inches from the lower end, so that they serve as supports in the central portion of the board. Two boards, approximately four inches wide and eight inches long, forming a portion of the floor, are placed at the upper end, extending from the upper 2 × 4 down to the upper 1 × 2. Two similar boards, but 24 inches long, are placed between the lower 2 × 4 and the lower 1 × 2, completing the major portion of the trough with the exception of an area 28 inches long in the upper portion of the board. This area is covered by an aluminum plate, 9¼ inches wide by 30 inches long, which is nailed on either side to the long members of the board and above and below to the floor of the board. The board is attached to a footpiece composed of two 2 × 4's, 24 inches long, and fastened at either end by a 1 × 2 crosspiece, 12½ inches long. The board is fastened to the footpiece by means of two heavy hinges. Braces on either side extend from the back part of the footpiece up to a point about twenty-one inches above the lower end of the board. These braces, which have a slot extending throughout the entire length, are 24½ inches long by 2 inches wide. On either side of the board proper are right-angled side boards similar to those in the Stewart board. They are 20 inches long and are so arranged

that the distance between them can be varied. They are fastened by screw nuts which attach the base of the sidepeice to the fasten the animal in position. Adjustable canvas belts four and six inches in width, which pass completely around the board,

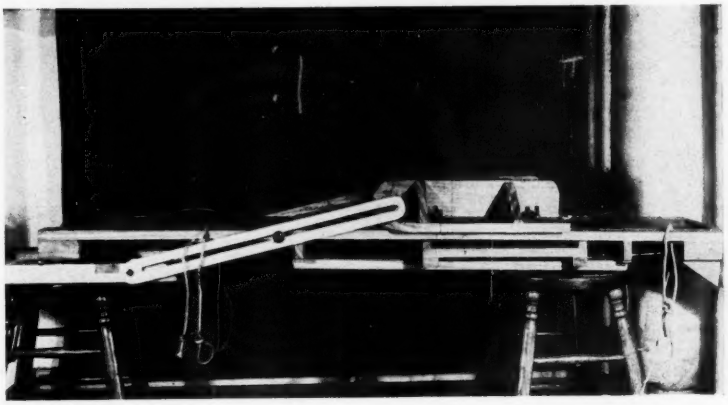

Fig. 4. Horizontal position of board, showing relative position of braces.

board proper. The side boards may also be adjusted for different levels. By decreasing or increasing the distance between the two side boards almost any animal can be accommodated and held securely in the antero-posterior position.

An adjustable plate carrier is mounted on the back side of the board, travelling on two tracks 30 inches long, composed of boards seven-eighths inch thick and one and five-eighths inches wide. The plate carrier itself is 12½ inches wide by 14 inches long, designed to carry an 8×10 cassette holder. A five-eighths inch space between the front of the plate carrier and the back part of the board is present so that the cassette may be introduced. The carrier is adjustable and is suspended by a rope extending to the upper part of the board, which passes over a "lock" pulley. The plate may be adjusted without changing the position of or disturbing the animal. Ropes introduced through holes on either side of the upper and lower ends of the board are used to further serve to fasten the animal securely. The animal is fastened on the board in the horizontal position, following which the board may be placed in any position up to and including the vertical with no effort.

VISUALIZATION OF BILIARY AND PANCREATIC DUCTS BY THE USE OF SODIUM IODIDE

By RALPH L. TROUP, M.D., Department of Roentgenology, Green Bay Clinic, Green Bay, Wisconsin

A male, aged 30, came to the Clinic for an examination on January 1, 1930, with a chief complaint of chills, fever, and jaundice of two years' duration. In 1919, the patient had had a cholecystostomy performed for chills, fever, and jaundice. Following this he felt well until March, 1928, when he developed severe chills followed by fever and became jaundiced for several days. He continued to have these attacks more

frequently until September, 1928, when cholecystectomy was performed. Following this, the patient obtained relief for three months, when the same trouble reappeared. This time he had severe chills, lasting for

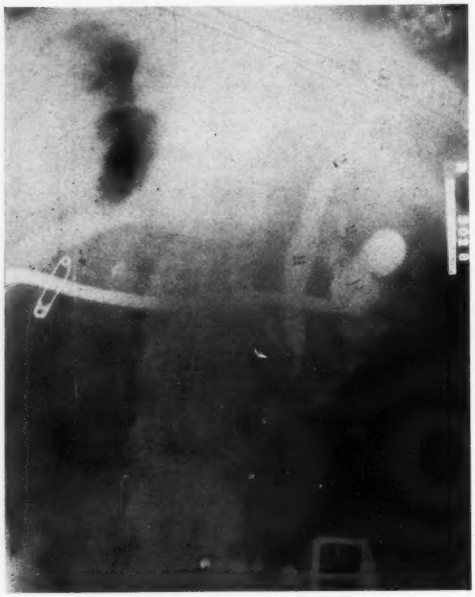

Fig. 1. See text.

from thirty to sixty minutes, with an associated fever. He also became nauseated and vomited, and marked jaundice was present, with some pruritus. During the past two years he has had attacks once a month, lasting for several days, but for the five weeks previous to examination the attacks have occurred once or twice a week, being much more severe than the previous ones. Following an attack, he becomes very weak and prostrated. His stools were usually acholic, and the urine very dark.

Physical Examination.—The patient was apparently very sick. The skin and sclera were jaundiced II, the liver palpable in the midline and tender II on pressure. The spleen was palpable on inspiration. He had hemorrhoids II. The feces were acholic. His blood pressure was 110 systolic and 80 diastolic. His pulse rate was 70 and his temperature normal.

Laboratory Examination.—Blood count: hemoglobin 65 per cent, erythrocytes 3,920,000, leukocytes 4,900. Fractional test meal: total acidity 20, free hydrochloric acid, 16. Blood Wassermann, negative.

The roentgenologic examination of the stomach was negative.

The diagnosis of common duct stone was made and exploration was advised, but this was not done until March 2, 1931. When he opened the abdominal cavity, the surgeon found very dense adhesions with many small pockets containing vaseline, which had been poured into the wound at the last operation. He was finally able to dissect the liver free from adhesions and to discover the stump of the gall bladder. Because of the patient's poor condition, a mushroom catheter was sutured into the stump of the gall bladder. The patient made an uneventful convalescence and much bile drained through the catheter.

Two weeks following operation, sodium iodide was injected through the catheter until the patient complained of distress. One ounce of 12 per cent solution was used and a roentgenogram was made. The roentgenogram (Fig. 1) showed: I, Drainage tube; II, pancreatic duct; III, dilated common bile duct; IV, cystic duct; V, stump of gall bladder; VI, junction of common bile duct and pancreatic duct; VII, dye seen in duodenum; VIII, hepatic duct; IX, right and left hepatic ducts and some of the biliary tree in liver.

Figure 2 is an enlargement of Figure 1 to show: I, Drainage tube; II, pancreatic duct; III, dilated common bile duct; IV, cystic duct; V, stump of gall bladder; VI, ampulla of Vater—showing negative shadow occupied by stone with narrow band of dye along stone passing into the duodenum; VII, dye in duodenum.

A second attempt to remove the stone was made on June 10, 1931. This was not ac-

complished because the surgeon opened the large bowel in attempting to free the adhesions. The abdomen was closed, the tube right. The tube was removed in the early part of September and the wound healed promptly.

Fig. 2. See text.

being left in, and the patient made an uneventful convalescence. In July, 1931, a large amount of sour, greenish material came from the tube. This was examined and found to be gastric contents. The patient was given methylene blue, which drained from the tube in a few minutes. Due to the loss of a large amount of gastric contents, the patient felt very weak, so the tube was clamped off and he soon felt all

COMMENT

This case is reported because of complete visualization not only of the biliary tract but also of the pancreatic duct. A fistula was evidently established between the duodenum and the common duct, probably due to ulceration of the stone into the duodenum. The patient experienced no untoward effects from this injection of sodium iodide and to-day feels perfectly well.

EDITORIAL

LEON J. MENVILLE, M.D. . . . *Editor*
BUNDY ALLEN, M.D. . . *Associate Editor*

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METHODS OF MEASURING RADIANT ENERGY

The present writer for years has stressed the necessity of measuring the intensity of radiant energy as used in physiologic or therapeutic work. In a recent critique, Coulter and Smith[1] have the following to say: "In respect to these experiments and many similar ones, it would be impossible for another group of investigators to duplicate the dosage, as apparently neither the quantity nor the quality of the radiation was sufficiently measured nor is it recorded that variations of the individuals were considered. Thus the use of ultra-violet radiation in secondary anemia is still in the experimental stage." According to Davis,[2] of the Laboratories of the Desert Sanatorium and Institute of Research, Tucson, "It must be admitted that at present little knowledge is available to the diagnostician to enable him to determine proper dosages of radiant energy. The medical profession has knowledge of some important principles of heliotherapy which clinical experience and biologic experimentation have indicated. But in the case of John Jones, suffering with a particular type and severity of arthritis or with surgical tuberculosis in a certain stage, it is impossible at present to say just what doses of sunshine or of artificial radiation will exert the most beneficial influence toward recovery. Yet it is evident that such an optimal dosage must exist. We do know that excessively large doses are injurious and that excessively small ones are without discoverable effect. In between such values must lie a value which is best for John Jones in his particular condition. The color and texture of his skin, the sensitivity of his reflex centers, his mental condition, and many other factors may influence his reactions to irradiation. Therefore, the problem of determining the optimal dosage for him is complicated and difficult of solution. Reliable measurements of the intensity and wave length of the radiation used in irradiation experiments are of first importance. Ideally, we should know the radiant power at each wave length employed, at every instant during the time of irradiation. Actually it is very difficult in many cases to measure those quantities continuously while the experiment is in progress."

The methods available for measuring and specifying the total amount of energy emitted by a source, as well as its spectral distribution, may be placed in two groups. There are those employing accurate physical methods, such as thermo-electric measurements (radiometry), chemical reactions (including spectrophotometry), the discharge of electrons, etc. In contrast to these accurate physical methods, the mastery of the technic of which is really, after all, not nearly so difficult as that of many of the clinical laboratory and operative procedures now commonly used, are numerous photobiologic and photo-chemical procedures, designed for rapid and easy use. These latter methods merely gauge the gross intensity of ultra-violet, either total or of certain wave

[1] J. S. Coulter and E. M. Smith, Jr.: RADIOLOGY, May, 1931, XVI, 737-743.
[2] G. E. Davis: General Electric Rev., February, 1931, p. 98.

FRANCIS CARTER WOOD, M.D.
President of the Radiological Society of North America

lengths, but give no information as to the relative intensity of the wave lengths in that region. Many of them are worthy of only passing mention, such as that of Bang[3] and of Angus[4] based on the rate of killing of bacteria and infusoria, respectively, and of Koeppe[5] based on the extent of hemolysis produced in a suspension of red blood cells in quartz test tubes. Erythema following irradiation has been emphasized as a means of estimating the intensity of ultra-violet radiation, because many believe that the only biologically important wave lengths are those which produce erythema. Luckiesh[6] advocates the use of the erythemal curve, as a parallel method or basis of appraisal to measuring devices, because it encompasses a range of maximum biologic importance, and because the maximum of effectiveness is at a wave length (297 mμ) either coincident with or fairly close to that of the antirachitic maximum. The papers by Hausser,[7] Hausser and Vahle,[8] Luckiesh, Holladay, and Taylor,[9] and Uhlmann[10] give detailed information concerning the relative effects at different wave lengths.

Some time ago, Hausser and Schlechter[11] pointed out that the effectiveness of radiation in the production of erythema does not merely depend upon wave length, because the quality of erythema is different according to the wave length of the radiation used to produce it. For instance, if the minimal amount of energy which gives rise to a mild erythema of Grade 1 be determined for certain wave lengths, and then multiples of this be used, a similar effect is not obtained for the different wave lengths. While the degree of erythema produced by an irradiation with 254 mμ slowly increases as the duration is prolonged, the increase is very rapid for wave lengths around 313 mμ, so that doubling or trebling the dose leads to blister formation. The time course of the appearance and disappearance of the erythema is also quite different, that at 253 mμ appearing some time after the maximum effect has been reached at 297 mμ, and disappearing very much more quickly. In other words, taking the "erythema dose" as a biologic measure of radiation may lead to considerable error.

Of the photo-chemical methods, that of Clark[12] stands pre-eminent, and it has been much used in clinical and qualitative laboratory work. Clark proposed that the intensity (in ergs per sq. cm. per second) necessary to darken lithopone paint to a reflection factor of 50 per cent be taken as a unit of intensity of ultra-violet. There is no perceptible darkening when the paint is irradiated through ordinary window glass with cut off at 320 mμ. The light-sensitiveness of lithopone is described by Brickwedde.[13] In 1929, Clark[14] substituted chemically pure zinc sulphide, moistened with lead acetate, for the lithopone. Recently (1931), she has given[15] some results on the ultra-violet, to which the method is sensitive, in Baltimore sunlight.

The method of Anderson and Robinson[16] is based on the decomposition of oxalic acid in solution with uranyl sulphate, the milligrams of oxalic acid decomposed, determined by titration against a standard permanganate solution, being calculated to ergs. Pohle[17] developed the Bering and

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[3]S. Bang: Verhandl. d. klimatolog. Tagung in Davos, 1926, p. 252.

[4]T. C. Angus: Proc. Roy. Soc. B, 1925, XCVIII, 400.

[5]H. Koeppe: Arch. Kinderheilk., 1927, LXXXI, 1.

[6]M. Luckiesh: Artificial Sunlight Combining Radiation for Health with Light for Vision. D. van Nostrand Co., Inc., New York, 1930, p. 72.

[7]K. W. Hausser: Strahlentherapie, 1928, XXVIII, 25-44.

[8]K. W. Hausser and W. Vahle: Strahlentherapie, 1921, XIII, 41.

[9]M. Luckiesh, L. L. Holladay, and A. H. Taylor: Jour. Optic. Soc. Am., August, 1930, XX, 423-432.

[10]E. Uhlmann: Strahlentherapie, 1930, XXXV, 361-368.

[11]K. W. Hausser and E. Schlechter: Strahlentherapie, 1927, XXVII, 348-352.

[12]J. H. Clark: Am. Jour. Physiol., June, 1924, LXIX, 200-209.

[13]F. G. Brickwedde: Jour. Optic. Soc. Am., 1927, XIV, 312.

[14]J. H. Clark: Am. Jour. Hyg., May, 1929, IX, 646-662.

[15]J. H. Clark: Jour. Optic. Soc. Am., 1931, XXI, 240.

[16]W. T. Anderson and F. W. Robinson: Jour. Am. Chem. Soc., 1925, XLVII, 718.

[17]E. A. Pohle: Jour. Am. Med. Assn., 1926, LXXXVI. 818.

Meyer method in which a solution of hydriodic acid in water frees iodine under the influence of intense energy. Webster, Hill, and Eidinow[18] take the amount of bleaching, found to be proportionate to the length of exposure, of methylene blue in an acetone-methylene blue mixture in quartz tubes as indicative of the intensity of ultra-violet. In a later paper, Hill[19] reported that the standard color tubes made with methylene blue do not keep well, especially in warm weather, and recommended that they be made with copper nitrate and potassium chloride. Kimball and Hand[20] believe that this method gives only approximate comparisons from day to day, dependent upon many factors, such as the purity of the chemicals and their temperature. Numerous fluorescent "actinometers" have been developed, for example, those of Gyemant,[21] Pfund,[22] and Anderson and Gordon.[23]

A number of investigators have made use of the cadmium photo-electric cell, notably Dorno,[24] as well as Pohle and Sawyer,[25] Griffith,[26] and Harris.[27] Burt, at Pasadena, has developed an ultra-violet photometer, the essential feature of which is a quartz bulb photo-electric cell, the inside of which is coated with sodium. The Westinghouse Electric and Manufacturing Company has also developed a photo-electric cell method with a graphic recording device. Kunz and Shelford[28] have recently reported on gas-filled photo-electric cells for measuring sunlight under various conditions. Some of the cells exhibit a direct proportionality between intensity and current up to a certain limit. Stockbarger and Burns[29] describe a method in which photo-electric cells and filters can be used to measure intensities of radiation within narrow regions by employing the flicker principle.

Any device which has a peculiar sensitivity curve, such as most, if not all, photo-electric cells have, despite its high sensitivity in a particular part of the ultra-violet (*c.g.*, 300-320 mμ), has limited applicability. It simply gives information concerning the relative amounts of energy emitted by a source at particular wave lengths. The writer has never been able to become even mildly interested in any method which gives merely an approximation of the amount of ultra-violet of certain wave lengths being emitted by a certain source. The explanation of such an interest is due to the overpowering effect of the demonstration that certain wave lengths in this region are antirachitic. This has been injudiciously allowed to warp the judgment of many into believing that these same wave lengths, or nearby ones, are the only ones effective in many conditions.

The radiometric method, using a thermopile or thermocouple connected with a high sensitivity galvanometer, with a definite response proportional to the incident energy intensity at all wave lengths, is always the court of last resort, since photographic and photo-electric instruments must be standardized by reference to some non-selective device. Radiometry is the élite method for measuring radiant power. It involves the measurement of the heat produced when ra-

[18] A. Webster, L. Hill, and A. Eidinow: Lancet, April 12, 1924, I, 745-747.

[19] L. Hill: Lancet, 1924, II, 299.

[20] H. H. Kimball and I. F. Hand: Bull. Nat. Research Council No. 61, 1927, p. 123.

[21] A. Gyemant: Jour. Optic. Soc. Am., 1926, XII, 65.

[22] A. H. Pfund: Bull. Johns Hopkins Hosp., 1927, XL, 228.

[23] W. T. Anderson and E. Gordon: Jour. Optic. Soc. Am., 1928, XVI, 224.

[24] C. Dorno: Physik der Sonnen und Himmelsstrahlung, 1919.

Idem: Klimatologie im Dienste der Medizin, 1920.

Idem: Strahlentherapie, 1924, XVIII, 177.

Idem: Strahlentherapie, 1924, XVIII, 721.

Idem: Jahrb. d. Naturforschenden Gesell. Graubundens zur Feier des 100 jährigen Bestandes, 1925-26, N. F. 64, 215.

Idem: Handb. der Prak. Therapieals Ergeb. Exper. Forschung., 1926, I, 367.

Idem: Verhandl. d. klimatolog. Tagung in Davos, 1926, p. 130.

Idem: Strahlentherapie, 1926, XXII, 71.

[25] E. A. Pohle and R. A. Sawyer: Am. Jour. Roentgenol. and Rad. Ther., October, 1928, XX, 338-348.

[26] H. D. Griffith: Strahlentherapie, 1928, XXIX, 592-601.

[27] D. T. Harris: Jour. Sci. Instr., 1929, VI, 7.

[28] J. Kunz and V. E. Shelford: Rev. Sci. Instr., 1930, I, 106.

[29] D. C. Stockbarger and L. Burns: Rev. Sci. Instr., 1930. I, 76.

diation is absorbed, the intensity being expressed quantitatively as the number of calories, or ergs, produced per unit area of absorbing material. Radiometers are non-selective, having blackened receiving areas, that is to say, they are equally sensitive to all wave lengths of the radiant energy spectrum. In consequence, all energy, regardless of wave length, is absorbed and transformed into heat. The responses of non-selective receivers are directly proportional to the intensity of the incident radiation because, for the small rise in temperature involved, the thermal electromotive force is directly proportional to the heat generated, which in turn is directly proportional to the energy absorbed. The advantage of the thermal junction over other methods is the ease and accuracy with which it can be calibrated to obtain the measurements in absolute value by resorting to the use of standardized incandescent lamps, operated at a defined voltage or current, and with the intensity of the total radiation at a fixed distance, and in a definite direction, known to a high degree of accuracy. Coblentz[30] has given particularly good accounts of this method. His papers and other pertinent literature are referred to in a publication by Laurens and Mayerson.[31]

The use of screens or filters, even when corrections are made for reflection and absorption, to give the percentage values of the ultra-violet, luminous, and infra-red is only an approximate method, although very convenient and extensively used (Gibson[32]). Filters to give certain regions of the spectrum may be used when, because of the impossibility of obtaining required intensity, it is not feasible to isolate the desired regions by means of a monochromator. The advantages of filters lie in their simplicity and conservation of energy. They do not, however, afford the analysis possible with a spectrometer. Jones[33] has recently developed a number of filters made up of selectively absorbing materials.

To supplement results obtained with filters, radiation should be dispersed by monochromators or spectrometers, having optical parts transparent to ultra-violet and infra-red as well as to luminous energy, and the energy in consecutive narrow bands measured by means of a linear thermopile, placed at the exit slit, connected with a galvanometer. With such instruments one may determine the distribution of the radiant energy (per cent of the total) emitted by various sources in narrow bands of the three major spectral divisions (ultra-violet, luminous, and infra-red), the wave length limits of the transmission of filters, as well as the wave length percentage transmission of filter (*i.e.*, the percentage of the incident radiation which gets through after the loss suffered by the transmitted rays due to reflection and scattering).

For simply determining the wave length transmission of substances in the ultra-violet and visible regions of the spectrum, spectrograms are all that are really necessary. These give the cut-off in the ultra-violet and qualitatively indicate any absorption at longer wave lengths. Spectrograms, of course, also indicate the general nature of emission spectra. McNicholas[34] and Davis and Sheard[35] describe the methods. The spectro-photometric method consists essentially in determining at what wave length two contiguous spectra are of equal density; and this value, by this method, is independent of the kind, the law, the chromatic sensitivity, or the length of development of the plate, as well as independent of the kind of

[30]W. W. Coblentz: RADIOLOGY, February, 1928, X, 116-121.
Idem: Med. Jour. and Record, 1929, CXXX, 691.

[31]H. Laurens and H. S. Mayerson: RADIOLOGY, April, 1929, XII, 328-340.

[32]K. S. Gibson: Jour. Optic. Soc. Am., 1926, XIII, 267.

[33]L. A. Jones: Jour. Optic. Soc. Am., 1928, XVI, 259.
Idem: Jour. Nutrition, November, 1929, II, 111-123.

[34]H. J. McNicholas: Bur. Stand. Jour. Research, 1928, I, 939.

[35]G. E. Davis and C. Sheard: Jour. Optic. Soc. Am., 1931, XXI, 47.

developer, the variations in the intensity of the source, and the length of the exposure. The per cent transmission is determined arbitrarily by the ratio of sector openings, the wave length being the dependent variable. For the details of the method the papers by Laurens and Mayerson,[31] McNicholas,[34] and Davis and Sheard[35] may be consulted.

The spectro-radiometric method gives results which are in agreement with photographic determinations made with a sector photometer and quartz spectrograph in the ultra-violet and visible. But, since the photographic method is not readily adapted for measuring the intensity of radiation in the infra-red, only part of which can be photographed by the use of very specially sensitized plates, the radiometric method is the only one to use in determining the intensity of dispersed infra-red. Anderson, Fraser, and Bird[36] did an important service in calling attention to the necessity of a consideration of the transmission of ultra-violet by quartz monochromators. They found that the transmission of a monochromator varied between 20 per cent for wave length 248 mμ, and 8.8 per cent for wave length 404.5 mμ. Forsythe and Barnes[37] state that the transmission of a monochromator of theirs is about 25 per cent at 260 mμ, about 40 per cent at 360 mμ, and about 48 per cent at 600 mμ.

There are a number of points which may be cited to show further the necessity of making measurements of this sort. (1) If the energy distribution of a source changes, due to variation in power input, then the transmission of a screen will also change; for example, it is necessary to determine the transmission in terms of the energy input of the source of energy. (2) In the making of screens manufacturers have difficulty in reproducing the same conditions in different melts, so that the cut-off in the ultra-violet, as well as the transmission as to wave length, varies in different samples of the same kind of screen. In order to obtain exact data it is necessary to determine these factors on samples from each melt. (3) The drop in the transmission curve in the ultra-violet for screens is not a sharp one, but it covers a region of several wave lengths in sweeping from nearly full transmission to absolute cut-off, neither of which points represents the effective cut-off. The zero limit of transmission ascertained from a spectrogram may thus be a misleading measure of the value of a material for purposes of ultra-violet transparency. A screen transmitting to 270 mμ is likely to absorb a large portion of the energy in the neighborhood of 300 mμ. Spectro-radiometric and spectro-photometric determinations of transmission in terms of the energy distribution of the source give this information. (4) Of outstanding interest in connection with the transmission of screens, and in particular of some of the substitutes for quartz, is the fact that the percentage transmission, total and as to wave length, decreases with increasing duration of exposure to sunlight and artificial radiation. Nothing could illustrate more cogently, unless it be a deteriorating mercury lamp, the necessity of constantly making radiometric and photometric measurements to determine the total amount of energy, its spectral distribution, the shortest and longest wave lengths transmitted, and to what extent. (5) When using a screen that has a cut-off, let us say, between the ultra-violet and the luminous, we must not forget that it probably has a cut-off somewhere in the infra-red. Suppose we have an amber glass, for example, Corning Noviol 0, with a cut-off at 370 mμ, everything shorter than this being absorbed, with a typical percentage transmission from here up through the luminous. It is seldom realized that the transmission, though it continues into the infra-red region, eventually decreases, so that at about 3,500 mμ the glass transmits

[36]W. T. Anderson, H. D. Fraser, and L. F. Bird: Jour. Optic. Soc. Am., 1928, XVII, 454.

[37]W. E. Forsythe and B. T. Barnes: Rev. Sci. Instr., 1930, I, 569.

only 25 per cent of the incident energy (see Laurens and Mayerson[31]). To disregard this infra-red cut-off will give rise to error in the calculation of the distribution of energy between the ultra-violet, luminous, and infra-red portions, particularly if there is much energy in the infra-red spectrum of the source at longer wave lengths than this. Solar radiation contains not very much, that of the carbon arc, more. As a matter of fact, the infra-red absorption is not much greater for yellow glasses than for white.

In order to know just how much energy is being administered it is essential for anyone working on the influence of sunlight to measure solar and sky radiation both spectrographically and radiometrically. At our laboratory, spectrograms of the sun are made in order to show the shortest wave length present for the time of day, season, etc., and the total intensity of the radiation is then determined pyrheliometrically. Marvin and Kimball[38] describe various forms of the pyrheliometer. For sunlight we use the one described by Gorczynski.[39] This instrument, built by Jules Richard of Paris, consists of a large Moll surface thermopile and a registering millivoltmeter. It is a handy, sensitive, and accurate instrument. It is carried on a clock-driven equatorial mounting which, with a hand-operated altitude and azimuth adjustment, maintains the surface of the thermopile at right angles with the incident rays. The calibration of the instrument and of the recording millivoltmeter is described by Laurens and Mayerson.[31] By the use of appropriate screens, not only is the total amount of energy from the sun determined, but its distribution between ultra-violet, luminous, and infra-red as well. We also use one of the thermo-electric pyrheliometers of Kimball and Hobb,[40] as made by the Eppley Laboratory. This thermopile, attached to a recorder, permits of the determination of the total radiation from the sun and from the dome of the sky. The instrument is calibrated so that the record of the thermo-electric current is read as g. cal. per sq. cm. per minute. By means of screens it is again possible to obtain values for the distribution of the energy.

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[38]C. F. Marvin and H. H. Kimball: Jour. Franklin Institute, 1926, CCII, 273.

[39]L. Gorczynski: Jour. Optic. Soc. Am., 1924, IX, 455.

[40]H. H. Kimball and H. E. Hobbs: Jour. Optic. Soc. Am., 1923, VII, 707.

RADIOLOGY AND PATHOLOGY

In the practice of any medical specialty, there is more or less dependence upon and interrelation with the other specialties. The axiom, "No man liveth unto himself alone," may well be stated "No specialist practiseth unto himself alone." In spite of modern specialization, the human body still remains as a unit, and a patient with symptoms referable to one specialty may have the cause of these residing in an organ within the domain of still another. Because of the breadth of each and its importance to all specialties, radiology and pathology stand in a unique as well as an important relationship to one another. Radiology makes use of the roentgen ray and radium in the study, diagnosis, and treatment of disease. Pathology marshals and uses every possible phase of pure and applied science in examining products and portions of the body that may be obtainable for the purpose of aiding in the diagnosis and treatment of disease.

Modern diagnosis rests firmly upon the foundation of these sciences. No one realizes it more (perhaps unconsciously) than the laity, for whom an X-ray examination or blood test has a well known fascination. Every radiologist and pathologist is familiar with the individual who wants an X-ray examination or blood test, who, when questioned, states that he is merely sick and

wants to find out what is the matter. If either of these sciences were to be suddenly removed from modern medicine, the entire structure would collapse. Some of the old-school clinicians decry the progress of modern medicine in these directions, but they do not seem to impede its progress. Every clinical practitioner needs the fact finding these sciences offer. There is the occasional clinician who insists that he needs neither; perhaps there is that rare individual whose diagnostic acumen has little need for them, but nevertheless there still remain many fine points of differential diagnosis that are radiologic or pathologic in character.

Fundamental training in pathology has long been recognized as being both desirable and important for the clinician. This is evident in undergraduate and post-graduate schools. In the former, pathology is a major subject in sophomore and junior years, and in post-graduate schools from six months to a year is required to precede the clinical training. In radiology, however, it is even more important than in the other specialties that there be a thorough training in pathology. The proper interpretation of variations in density on an X-ray film is certainly achieved through a knowledge of those changes which produce them. Familiarity with the gross and microscopic appearance of tissue, with the resultant process of disease in terms of tissue change, rather than as a clinical symptom, cannot but help to aid the radiologist greatly in his interpretations. In addition, the proper interpretation of laboratory findings is always improved by familiarity with procedures and personal knowledge of limitations of technic. Then there is the understanding and interpretation of tissue diagnoses and descriptions, so important for subsequent radiotherapeusis. It cannot be expected that the radiologist be a tissue pathologist, but a certain knowledge of tissue pathology improves his ability to direct properly the treatment of cancer and to prognosticate the effects of such treatment. But even with the training suggested, the radiologist remains to a great extent dependent upon the pathologist.

Discussion by the radiologist and pathologist of the nature and interpretation of laboratory findings in a given case is often of value in radiologic interpretation, diagnosis, and treatment. This is most important in the treatment of neoplasms. Proper radiologic therapy of cancer is often dependent on the interpretation of the microscopic findings, and the radiologist's prognosis is partly dependent on the interpretation of the pathology. It need hardly be mentioned that knowledge of laboratory findings will often aid the radiologist in his interpretation of the X-ray film. There are some radiologists, however, who work objectively, entirely, interpreting the findings as they see them, not desiring any information about the patient. This attitude is scientifically commendable, but, practically, there is little question but that an interpretation given with knowledge of the clinical status of the patient is more valuable. If a patient has a tubercle bacilluria, how much better that the radiologist should know it when interpreting a pyelogram.

Co-ordination of clinical, radiologic, and pathologic findings is often difficult, and consultation and conference between the clinician, radiologist, and pathologist should be encouraged, although in the average hospital it is seldom done. It is only by such means that proper co-ordination of results can be obtained. Such conferences would lessen the incidence of bilateral pyelography on a patient with a low kidney function, and many other common apparent errors in judgment, but actually lack of proper co-ordination. Most important of all is the conference between surgeon, pathologist, and radiologist in relation to cancer diagnosis and treatment. The final diagnosis of cancer practically always rests with the microscope, but the problem of biopsy, and

limitation of surgical and radiologic treatment, can best be determined by these three individuals working as a team. The exact location for biopsy, the advisability of treatment immediately following biopsy, and the later treatment are not problems for a single individual but for a team. Any cancer is of sufficient importance to need the combined opinions of an experienced radiologist, pathologist, and surgeon for proper management.

As an example of increased efficiency in routine diagnosis, Bain[1] analyzed 347 cases for diagnosis, all of which had the co-ordinated work of clinician, radiologist, and pathologist. Of these, 51 per cent were diagnosed by clinical means, 35 per cent by radiologic, and 14 per cent by laboratory. These did not include post-operative tissue diagnoses.

From the radiologist, the pathologist has much to learn. This is most evident in bone pathology, in which the correlation of the roentgen film and microscopic study make the complete picture.

Many small communities and hospitals are unable to afford, or do not have material for, full-time specialism, hence there evolve men who combine two or more. Examples of these in relation to those specialists under discussion are surgeon-radiologist, internist-radiologist, surgeon-pathologist, internist-pathologist, and radiologist-pathologist. This latter combination, when possible, is the most desirable to consummate because of the close relationship between the two specialties and because they are both laboratory sciences. Individuals who combine them are quite indispensable.

Combined training in these two specialties, because of their fundamental nature, makes an excellent foundation for special training in other medical specialties and especially for general practice. With such training there would be more intelligent use of these fundamental sciences.

With such close scientific and practical relationship existing between these sciences, it behooves those practising them as specialties to co-operate most fully, so that they may be better able to interpret their findings.

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[1]Walter G. Bain: Illinois Med. Jour., December, 1927, LII, 479.

COMMUNICATIONS

THE ANNUAL MEETING

The officers elected at the Seventeenth Annual Meeting, held in St. Louis, from Nov. 30 to Dec. 4, 1931, are as follows:

President-elect, Byron H. Jackson, M.D., of Moses Taylor Hospital, Scranton, Pennsylvania; *Secretary-Treasurer,* Donald S. Childs, M.D., of College of Medicine, Syracuse University, Syracuse, New York; *First Vice-president,* W. Herbert McGuffin, M.D., of Calgary, Alberta, Canada; *Second Vice-president,* Col. Henry C. Pillsbury, M.D., Chief of U. S. Army X-ray Service, stationed at the Presidio, San Francisco; *Third Vice-president,* John D. Camp, M.D., Mayo Clinic, Rochester, Minnesota. The *Librarian,* Charles G. Sutherland, M.B. (Tor.), Mayo Clinic, Rochester, Minnesota, succeeds himself.

The new *Chairman of the Executive Committee* will be Léon J. Menville, M.D., of Tulane University, New Orleans. The President and President-elect are, by the terms of the Constitution, members of the Executive Committee. The *two new members* are Frederick H. Rodenbaugh, M.D., of San Francisco, and Thomas A. Burcham, M.D., of Des Moines, Iowa.

The Committee on Scientific Awards reported that it had made a survey of the scientific exhibits and had endeavored to judge them both as to their scientific value and the excellence of their presentation. In making

Banquet Scene, Seventeenth Annual Meeting of the Radiological Society of North America
Dec. 4, 1931, St. Louis

the following recommendations (which were adopted), the Committee wrote: "We wish to call attention to the immense amount of clinical material in this exhibit. In many cases your Committee found difficulty in making selections, owing to the exceedingly high value of all of the exhibits."

INDIVIDUAL EXHIBITS

First Place.—Ira H. Lockwood, M.D., of Kansas City, Missouri: "The Roentgen Examination of the Mammary Glands."

Second Place.—Frank B. Stephenson, M.D., and Kenneth D. A. Allen, M.D., of Denver, Colorado: "Bone Tumors."

Honorable Mention.—Paul F. Cole, M.D., of Springfield, Missouri: "New Application of the Potter-Bucky Grid to Any Angle, with Special Reference to Head Work."

HOSPITAL GROUPS

First Place.—Henry W. Meyerding, M.D., of the Mayo Clinic, Rochester, Minnesota: "Diagnosis and Roentgenologic Findings in Spondylolisthesis."

Second Place.—Samuel Brown, M.D., of the University of Cincinnati Medical College, Cincinnati, Ohio: "Thoracic Aorta."

Honorable Mention.—John D. Camp, M.D., of the Mayo Clinic, Rochester, Minnesota: (1) "Roentgenologic Changes in Intracranial Disease" and (2) "Roentgenologic Bone Changes in Hyperparathyroidism." John R. Carty, M.D., C. V. Kilbane, M.D., Sidney Weintraub, M.D., and John Remer, M.D., of Cornell Clinic, New York Hospital: "Some Unusual Thoracic and Gastric Lesions." Charles H. Heacock, M.D., Polyclinic Hospital, Memphis, Tennessee: "Intravenous and Serial Pyelo-uterography."

REPORT OF PUBLICATION COMMITTEE

The *Chairman,* W. Herbert McGuffin, M.D., reported on the questionnaire recently sent to the subscribers of RADIOLOGY, from 50 per cent of whom replies were received. Of these, 98 per cent responded that they were favorably impressed. At the Editorial Staff meeting, a summary of the replies received was read, and suggestions of value were offered and discussed by a considerable number of those present.

EXCELLENCE OF PROGRAM

There were 165 papers entered on the program, to which five days were devoted. The high degree of excellence of the entire program was a matter of comment by members and eminent visitors as well, the retiring President, Bundy Allen, M.D., of Tampa, Florida, and his Program Committee, receiving well-earned praise.

COMMENTS ON MEETING

During one evening session a motion picture depicting the salient features of bone tumors was presented by Charles F. Geschickter, M.D., of the Garvan Cancer Research Laboratory of the Surgical Pathological Laboratory of the Johns Hopkins University and Hospital, Baltimore.

The same audience that listened to Dr. Geschickter also was deeply interested in an address and motion picture presented by Francis Carter Wood, M.D., of the Crocker Laboratory of Columbia University, New York City. The film shows with a wealth of detail the work of this great experimental and pathologic laboratory, and no "movie" ever held its audience more enthralled. At the close, Dr. Wood explained upon what terms films are available for use before medical societies.

The registration at the meeting was 580, which may be considered a most excellent attendance. An eminent guest was present from Buenos Aires, Argentina, in the person of Carlos Heuser, M.D., who addressed the Society on the subject of arteriography by intravenous injection.

The several hundred who attended the

banquet were wholly delighted with the musical program provided by the St. Louis group, the musicians contributing to it being *artistes* of a high order. The address of the evening was delivered by the Honorable Joseph E. Ransdell, former United States Senator from Louisiana and present Executive Director of the National Institute of Health. He spoke with great earnestness of the Government's latest measures to promote public health, toward which the Chemical Foundation has contributed generously.

The floor plan of the hotel lent itself admirably to the accessibility of the commercial exhibit; in fact, the commercial exhibitors found themselves surrounded by the visitors at all times. The apparatus and drug houses which have exhibited with the Radiological Society in the past were all represented.

AWARD OF GOLD MEDALS

At the 1931 session of the Radiological Society of North America two awards of the Society's gold medal were made, one to M. J. Hubeny, M.D., of Chicago, and one to Carlos Heuser, M.D., of Buenos Aires, Argentina.

Dr. Hubeny has been a member of the Society since 1918, has served as President, as Editor of RADIOLOGY over a period of years represented by the first sixteen volumes of the publication, as President of the American College of Radiology, as Chairman and as Secretary of the Section on Radiology of the American Medical Association, and he has to his credit, besides, years of splendid work for the Society on committees. Yet it is not so much for his constructive work in the Society's behalf that the gold medal was awarded as for his achievements in the advancement of the science of radiology. He is credited with early work on focal infection which resulted in the publication, in 1921, of an important paper on "Determination of Dental Focal Infection by Means of the Radiograph." Among his other published papers may be enumerated the following, the very titles of which will indicate the broad field of his study and investigation: "Injection of the Sphenoid Sinuses with a Suspension of Barium Sulphate" (1921), "Economics and Socialization of Medicine" (1926), and "The Oblique Projection in Examination of the Lumbar Spine." He is the author, with W. A. N. Dorland, M.D., of the standard text entitled, "Roentgenography in Embryology and Obstetrics," which has also appeared in a German translation.

Dr. Heuser has done outstanding work in the development of the clinical application of the X-rays since the year following their discovery by Wilhelm Röntgen; nor has he ceased to investigate in new fields, as attested by experimental work reported in recent years. Dr. Heuser made the long trip from his home in South America to attend this meeting of the Society.

FLORIDA RADIOLOGICAL SOCIETY ORGANIZED

The Florida Radiological Society, composed of radiologists practising in the State of Florida, was formally organized on Nov. 14, 1931, at St. Petersburg, Florida, under the temporary Chairmanship of L. W. Cunningham, M.D., of Jacksonville, Florida. A Constitution and By-laws were adopted at this organization meeting, and the following officers were elected to hold office until the spring meeting in 1932:

President—L. W. Cunningham, M.D., St. James Bldg., Jacksonville, Florida.

Vice-president—Orion O. Feaster, M.D., Power and Light Bldg., St. Petersburg, Florida.

Secretary-treasurer—Frederick K. Her-

pel, M.D., Good Samaritan Hospital, West Palm Beach, Florida.

Meetings of the Society will be held twice yearly, in November and in May, at the same time as the meeting of the Florida State Medical Association.

ROENTGENOLOGICAL CONFERENCE

The New York Roentgen Society invites you to join with the New England Roentgen Society, the Philadelphia Roentgen Ray Society, and the roentgenologists of Baltimore and Washington in a Roentgenological Conference to be held in New York City on Friday, January 29, and Saturday, January 30, 1932. Headquarters: Hotel Pennsylvania.

J. BENNETT EDWARDS, M.D., *Secretary*, the New York Roentgen Socity. Address: 144 Woodridge Place, Leonia, N. J.

DECISION AGAINST THE LANGMUIR TUBE

A decision by the Supreme Court holds invalid the Langmuir patent on high vacuum tubes. In refusing to grant a hearing to the General Electric Company, the Court, Justice Stone speaking, declared that the tube patent was invalid for want of invention. In detail, it was said that the component parts were well known and had been employed to produce results similar to those produced by the Langmuir tube before the issuance of a patent upon the latter.

OWNERSHIP OF ROENTGENOGRAMS[1]

The question whether the roentgenograms of a hospital patient belong to the patient or to the hospital was answered by a court for the first time, so far as is known, in *Hurley Hospital vs. Gage,* decided on appeal, April 21, by the Circuit Court for the County of Genesee, Michigan. The patient had been roentgenographed in the roentgenographic department of the Hurley Hospital at Flint. The usual charge for the service was included in the patient's bill. He made a payment on account but refused to pay the charge for roentgenographic service unless the roentgenograms were delivered to him. The hospital refused to deliver them and sued the patient for the balance due. In the Justice's Court where the suit was instituted, judgment was given against the hospital. The hospital, however, because of the principle involved, appealed to the Circuit Court of Genesee County. At the hearing on the appeal, no one appeared on behalf of the patient and the case was heard and judgment rendered without the submission of evidence or argument by him.

In giving judgment, the court pointed out that the hospital sold and patients paid for, not the material that went into roentgenograms, but knowledge and experience. The protection of the hospital might depend largely on the proper preservation of the roentgenograms and, said the court, the films should remain with the hospital. Judgment was given against the patient for the balance due on his bill, covering the amount charged by the hospital for the roentgenograms.

[1]Reprinted by permission from *Journal of the American Medical Association,* Nov. 21, 1931, XCVII, 1542.

CORRECTION

On page 898 of the October, 1931, issue of RADIOLOGY, in the abstract of the paper on "Roentgen Cataract: Its Significance and Prevention," by Max Cremer, the last sentence should read as follows: "A thickness of 1.3 mm. of gold corresponds to a lead protection of 2 millimeters."

AMERICAN MEDICAL ASSOCIATION OF VIENNA

"Hofrat Prof. Holzknecht is dead"; so ran the sad news rapidly over Vienna. And the whole world was cognizant of that sad story in less than twenty-four hours. The man who paved the way for scientific medical roentgenology has gone. Up until a few hours before his death he faithfully performed his duties and worked upon problems in his chosen specialty.

The members of the American Medical Association of Vienna are to-day grieving the loss of this great roentgenologist, who was truly a martyr. Our official representative to the funeral and memorial services in the Roengten Institute of the Allgemeines Krankenhaus was Dr. G. von Poswik, whose interest in and appreciation of the work of Hofrat Prof. Holzknecht are well known.

SERIES OF PAPERS BY THE COLE COLLABORATORS

An important series of papers is to be published in RADIOLOGY, which our readers may await with considerable interest. It is "An Analytical Study of the Roentgenological Exploration of the Mucosa of the Gastro-intestinal Tract" by The Cole Collaborators, Lewis Gregory Cole, M.D., Robert Earl Pound, M.D., Russell Wright Morse, M.D., Courtenay I. Headland, M.D., William Gregory Cole, M.D., and Ames W. Naslund, M.D.

This material was presented in the form of a résumé of data at the Third International Congress of Radiology in Paris last Summer. The complete series of papers will include the reports of personal communications from many leading American roentgenologists, an extensive study of the foreign literature, the assembling of material from various institutions, and the designing and actual construction of apparatus for applying the localized pressure technic. The papers are to be illustrated by the finest type of reproductions of roentgenograms, with full explanatory captions.

The expense of reproducing illustrations of such supremely high quality, printed upon special paper, is, of necessity, great, and in excess of that which the Radiological Society of North America is able to finance. The Chemical Foundation has most generously offered to bear this additional expense, that readers of RADIOLOGY may have the splendid series presented in the most finished manner.

The honor of presenting this subject would, undoubtedly, have fallen to the late Preston M. Hickey, M.D., had he lived, and, considering this fact and the great honor and respect in which Doctor Hickey was held, not only by American roentgenologists but by specialists in this field throughout the world, the articles, when completed, are to be assembled in a bound volume as a memorial to the dean of American roentgenology, Preston M. Hickey, M.D.

BOOK REVIEW

ROENTGEN ATLAS OF DISEASES OF THE LUNGS: A MANUAL FOR PHYSICIANS (RÖNTGENATLAS DER LUNGENERKRANKUNGEN). By DR. W. BREDNOW, Privatdozent für innere Medizin und Röntgenologie an der Universität Göttingen, and DR. E. HOFMANN, Göttingen. A paper-bound volume of 167 pages and 85 illustrations and 1 *"Diapositivfilm."* Published by Urban and Schwarzenberg, Berlin, 1931. Price, 14 marks.

In a small volume the authors have dealt successfully with the problem of placing in the hands of the practitioner an atlas of roentgenograms exemplifying the more common varieties of pulmonary lesions.

The work was undertaken largely for the benefit of the physician not especially trained

in roentgenographic interpretation, and contains a system of exceptionally good reproductions. By means of the detailed analyses accompanying the illustrations, the authors express the hope of aiding the physician in rendering an independent evaluation of his own films. This is undeniably the most logical didactic method, and the expert reader will find few occasions to disagree with the interpretations offered by the authors.

In the introductory paragraphs the value of technically good roentgenographic work is stressed, and the authors point to the superior differential diagnostic value of roentgenographic over purely roentgenoscopic data.

Included is a brief but thorough consideration of the normal chest in which the authors point out certain non-significant findings which are often the basis for misinterpretation by the inexpert. Nearly half of the volume is devoted to the roentgenologic manifestations of the various types and complications of pulmonary tuberculosis. It is the opinion of the authors that this subject is of particular importance to the general practitioner, because it is he who has most frequent opportunity to see this disease in its incipiency. The analysis is thorough, and in every sense practical.

Non-tuberculous lesions are treated under two headings: (1) inflammatory, (2) neoplastic. Reproductions exemplifying the different types of pneumonia, pulmonary infarction, lung abscess, bronchiectasis, chronic bronchitis, passive congestion secondary to decompensated mitral disease, and silicosis are exhibited and analyzed in the text. Five examples of primary pulmonary carcinoma, accompanied by a discussion of the roentgenographic data, are given. The picture of pulmonary metastatic carcinoma, of Hodgkin's disease, lymphosarcoma, echinococcus cyst, and aortic aneurysm complete this section. The final section deals with the varieties of inflammatory disease of the pleuræ.

The reader who has become familiar with thoracic pathology as manifested roentgenographically will, perhaps, find little that is new or very illuminating in this volume. For such, however, it was not prepared. The authors intended merely to supply the general practitioner with a guide to aid him in his interpretation and to indicate to him the manner in which thoracic disease is manifested on the properly executed X-ray film. It may be, however, that the expert will find perusal of this volume profitable, if only as an example of logical inference and clear exposition—a facility with which is not possessed by all.

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THE APPENDIX (DIAGNOSIS)

Clinical and Radiologic Diagnosis of Chronic Appendicitis. Mario Buisson. Minerva Med., May 12, 1931, XXII, 714-724.

According to the author, the usefulness of radiography in the diagnosis of chronic appendicitis is not yet fully recognized. He answers the criticism of Bobbio and Buchmann by explicitly stating that of all the means available to the physician to-day, radiologic investigation is undoubtedly the best in its differentiating qualities; careful correlation of clinical and radiologic findings is obviously the diagnostic procedure of choice.

He notes that clinical diagnosis of chronic appendicitis relies almost exclusively upon pain detection in definite regions of the abdomen, pain which may or may not be caused by either direct or indirect action of a pathologic appendix. The importance often laid upon these tests is rather unfounded because the appendix is a mobile organ, the position of which is mainly determined by that of the cecum and of the colon; furthermore, its length is known to vary from 1 to 23 centimeters. The patient's history may not be of any substantial aid, because symptoms of chronic appendicitis are anything but clean-cut warnings.

The radiologic technic employed by the author consists in three consecutive daily administrations of from 200 to 250 gr. of barium sulphate diluted in from 400 to 500 c.c. of water sweetened by syrup, in fluoroscopic examination of the patient at the most suitable times, and in the taking of radiographs in various positions.

Normal appendices are distinctly visible; the pathologic appendix is visible in 80 per cent of the cases, but its outlines are not sharply defined and its shadow is not homogeneous. The absence of the appendicular image is a certain indication of appendicitis, this having been always confirmed by surgical control. If the appendix is located, its state may be further ascertained by direct palpation. Fluoroscopic investigation affords a means of detection of irregularities in the position of the appendix, its state of mobility, and the presence of adhesions. Irritation of the appendicular mucosa is characterized by the short time-interval in which the opaque food is retained in it. Furthermore, the author states that a pathologic appendix also alters the functions of the digestive tract, causing spasms of different natures and locations. He concludes by giving complete reports on eleven cases treated in his own clinic and illustrated by a large number of radiographs.

L. MARINELLI.

BLOOD CHANGES

The Effect of X-ray Therapy on the Partition of Phosphorus Compounds in the Blood in Disease. M. Sokolovitch. Brit. Jour. Exptl. Pathol., 1931, XII, 147-150.

The administration of X-rays influences and causes changes in the partition of the P compounds of the blood. The free P of the blood plasma and that of the red blood corpuscles undergo a change, but it is not uniform. The ester P of the plasma shows a tendency to rise, and the ester P of the corpuscles to fall slightly in amount. The lipin P of the blood plasma shows a tendency to increase markedly and the lipin P of the red blood corpuscles to decrease markedly in percentage.

CHEMICAL ABSTRACTS.

The Effect of Roentgen Rays on the Catalase Content of the Blood. Geremia Antonio. Minerva Med., May 5, 1931, XXII, 685, 686.

The author has studied the effect of X-rays on the catalase content of the blood of rabbits and men. As a unit of catalase quantity, the fixation index of the red cells, as obtained by Rigoni's method, was assumed. His results show that in rabbits one S.E.D. caused a marked increase in hematic catalase, inde-

pendently of the region irradiated. Man showed changes of the same nature under hepatic or splenic irradiation, corresponding to one S.E.D. at the surface, a dose of one-half S.E.D. causing no appreciable change.

The effects were detected two hours after treatment and remained unchanged or slightly weaker for two days, at which time they started to decrease rapidly and disappeared after ninety-six hours.

The author ventures the hypothesis that the increase of catalase content in the blood is a manifestation of the destructive action of the radiation on the cells of the body.

L. MARINELLI.

BONE (DIAGNOSIS)

Certain Radiographic Peculiarities in the Skeleton of an Acromegalic Giant. E. Forlini. L'Ateneo Parmense, January-February, 1931, III, 5-16.

This article treats of the radiographic examination of the cranium and other parts of the skeleton of a female acromegalic giant who died of pulmonary and intestinal tuberculous ulcers, in 1889, at the age of thirty-one.

The author's investigations, contrary to previous belief regarding acromegalia and acromegalic gigantism, revealed a lack of the frontal sinuses, and a marked decrease in size of the sphenoidal and molar sinuses. The absence of one of the frontal sinuses, however, has been observed also in normal individuals, according to Nylen, in 5 per cent of 2,000 cases examined.

In the epiphyses of the femora, tibia, and humerus, a small area of rarefaction and a diminished compactness of the trabeculæ were encountered, whereas there was increase in the thickness of the diaphyses.

Regarding the mandibles, it was found that lengthening of the lower jaw-bone may come about in two ways: In the first there may be lengthening without modification of the mental mandible angle; in the other, the angle assumes an amplitude quite disproportionate. While in the first case there are only very slight modifications of the two mandible branches, in the second case there are changes in the marginal faces and, more characteristic, modifications of the coronoid apophysis, condyle, sigmoid incisure, and their connections. These modifications, the author believes, are seen relatively early in connection with other skeletal manifestations and may furnish an element in the radiologic diagnosis of acromegalia and acromegalic gigantism.

W. W. WHITELOCK, Ph.D.

Supernumerary Tarsal Bones. Valentín C. Girardi. Prensa Méd. Argentina, Aug. 20, 1931, XVIII, 360-364.

The author gives a good review of this subject and concludes that of such bones the most common are: (1) The accessory scaphoid; (2) the accessory cuboid; (3) the os trigonum, and (4) the os vesalanium pedis. The advent of X-ray has brought with it a more complete knowledge of such bones, which is important because of their medico-legal and surgical interest. In adolescence they may present inflammatory processes resembling those present in epiphysis of growing people. They may present total or partial fractures.

N. G. GONZALEZ, M.D.

Fractures of the Pelvis. Everett O. Jones and H. T. Buckner. Northwest Med., June, 1931, XXX, 269-273.

Authors have described as many as ten different types of fractured pelvis, all of which can be covered by three main classes: (1) fractures of the wing of the ilium; (2) fractures of the acetabulum; (3) fractures of the pelvic ring. Fractures of the iliac wing are always the result of lateral compression, the forcing being too high to strike the pelvic ring. Fractures of the acetabulum result from a direct blow on the greater trochanter; when the force is delivered exactly parallel with the long axis of the femoral neck, the acetabulum will yield; a force at any angle to this axis will break the neck of the femur. Fractures anywhere in the pelvic ring result from lateral compression; when forcibly com-

pressed from opposite sides, the breaking points will be somewhere near the intermediate poles. This principle holds, whether there be simply one or more fractures of the rami or the complete double fracture of Malgaigne. In the first place, the lateral compression produces a fracture or fractures about the anterior pole and a distortion or rupture of the sacro-iliac articulation at the opposite pole. This is frequently not disclosed by the roentgenogram and is not discovered until the patient begins to get about. It is a very important factor in the production of disability following this type of injury.

W. W. WATKINS, M.D.

BONE (THERAPY)

The Pathology and Treatment of Colles' Fracture. M. Cole Rous. Jour. Med. Assn. South Africa, Sept. 26, 1931, V, 593-596.

Colles' fracture is caused by a fall on the outstretched hand, in such a manner that the forearm makes an angle of 60 degrees or less with the horizontal. The line of the fracture is oblique and runs from in front backward and upward. The lower fragment is displaced dorsally, proximally, and rotated backward around a horizontal axis. The stability of the wrist is preserved by the ulna alone, the distal end of which is attached to the radius by the triangular cartilaginous disk, and its styloid process is anchored to the medial aspect of the carpus by the collateral ligament. The distal fragment of the radius tends to become displaced proximally, but is held on its medial side by the cartilaginous disk and the ulna, and this serves as an anteroposterior axis passing through the ulnar attachment of the disk, around which the distal fragment swings. As the distal fragment and carpus are carried around this axis, a great strain is thrown on the medial collateral ligament and the styloid process of the ulna to which it is attached. It is this force which frequently fractures the ulnar styloid.

Every case presenting a painful wrist and a history of a fall on the outstretched hand should have a thorough examination. It is important to observe the relative positions of the styloid, remembering that this process of the radius is normally situated slightly distal to that of the ulna. While the normal radius presents a concavity just proximal to where the pulse is palpated, in this type of fracture this depression is filled by the distal end of the proximal fragment of the fractured radius. The comparison of the uninjured with the injured wrist is considered essential by the author. The X-ray examination is invaluable to show clearly the amount of displacement and to exclude or discover the presence of other injuries to the bones.

The anesthetic which is essential for proper reduction of the fracture may be either local or general. Lorenz Bohler, of Vienna, favors the former—has used it with success in 4,000 cases. In the reduction of this fracture the author favors his method of employing counter traction by means of a canvas strip passed around the lower extremity of the humerus, with the patient's elbow flexed to a right-angle. This allows the operator to use both hands in the reduction. The best and most satisfactory guide in the reduction is the X-ray, and whenever possible the reduction should be done under the fluoroscopic screen. The author believes it is better to see what one is doing in the darkness of an X-ray room than to work blindly by the light of day. A plaster splint molded to the patient's forearm is employed to hold the fragments in place. Roentgenograms should then be made as a final check for the position of the fragments.

J. N. ANÉ, M.D.

Operative Treatment of Y-shaped Fractures of the Lower Extremity of the Humerus. Terencio Gioia. Semana Méd., Nov. 6, 1930, XXXVII, 1407-1409.

As this fracture is rare and exceedingly difficult to reduce, the author reviews it in detail in this article. He presents the serious factors confronted; such as (1) difficulty in reduction, (2) traumatic arthritis, (3) exuberant periostitic proliferation, (4) Volkman's contracture, and (5) nervous complications. He presents a case with a typical Y-shaped

fracture on which he resorted to surgery, doing a permanent osteosynthesis with wire. His conclusion is that the best treatment in such fractures is the operative one.

N. G. Gonzalez, M.D.

BONE DISEASES (DIAGNOSIS)

Osteomyelitis of Gonococcus Origin in an Infant: Report of a Case. Philip Palew. Am. Jour. Surg., August, 1931, XIII, 246, 247.

The author reports a case of osteomyelitis of gonococcus origin. While a blood stream infection obviously was present, the original portal of entry for the organism could not be determined. X-ray films of the lesion accompany the report.

Davis H. Pardoll, M.D.

A Case of Co-existence of Congenital Luxation of the Ilium and Coxa Vara. Gabriele Sacerdote. Minerva Med., Apr. 21, 1921, XXII, 614, 615.

This article is a complete report of the clinical and radiologic findings obtained on a girl four and one-half years old.

Clinical examination revealed protruding trochanters, free movements with the exception of limited abduction of the left thigh. The head of the left femur was palpable under the femoral artery, the right seeming not to be in place. The spino-malleolar distance was 46 cm. on the right and 45 cm. on the left side; the greater trochanter was 5 cm. on the left and 6 cm. on the right above Roser-Nélaton's line; Trendelenburg's sign was positive in both sides.

The radiologic examination disclosed iliac luxation at the right and coxa vara at the left. The axis of the femur was at right angles with the axis of the diaphysis. The epiphysial line was irregular and too vertical to be considered normal, as it formed an angle of 12 degrees with the diaphysis; at its lower third portion it seemed split, both branches surrounding an inverted wedge-shaped nucleus. Surgical intervention was completely successful in correcting both defects.

The author mentions the very few cases described in the literature and insists upon the importance of determining the nature of the defect, because, while rickety anomalies of this kind improve with age, congenital ones tend to get worse and more difficult to correct.

L. Marinelli.

CANCER (DIAGNOSIS)

Precancerous Lesions of the Alimentary Tract: Lecture I. Matthew J. Stewart. Lancet, Sept. 12, 1931, CCXXI, 565-572.

The author in the Croonian Lectures delivered before the Royal College of Physicians of London on June 4, 9, and 11, 1931, states that of 56,896 deaths from cancer registered in England and Wales for the year 1929, 60 per cent in men and 42 per cent in women were referable to the alimentary tract. The most hopeful side of cancer research is that concerned with the demonstration of local causative factors and the recognition and prevention of precancerous lesions. The precancerous lesions of the alimentary tract are by no means so well established, nor are there the same opportunities for prophylaxis afforded as in the superficial forms of malignant disease.

The alleged precancerous lesions of the various portions of the alimentary tract are discussed under the following classifications:

(a) Chronic inflammatory lesions: (1) Leukoplakia; (2) lesions due to burns and chemical caustics; (3) cirrhosis of the liver; (4) hemochromatosis; (5) cholelithiasis and cholecystitis; (6) chronic gastric ulcer; (7) chronic gastritis; (8) chronic duodenal ulcer; (9) diverticulitis.

(b) Simple tumors as precursors of cancer.

(c) Lesions due to animal parasites.

The etiology of leukoplakia is different for different sites. In the mouth, syphilis is the chief cause. Excessive use of alcohol and tobacco were also given as causes. Leukoplakia

of the lip and of the vulva is not a syphilitic affection. Leukoplakia of the vulva is probably related to cessation of ovarian function.

Chronic inflammatory and obstructive lesions are associated with leukoplakia of the urinary tract.

Quoting from Lane-Claypon, a close association is shown between leukoplakia and cancer. The sex-incidence is similar, both preponderant in males (leukoplakia 95.8 per cent, carcinoma 90.2 per cent). Perrin's figures, quoted by Lane-Claypon, show 64 syphilitic leukoplakia buccalis with 10 carcinomas of the tongue, and 38 non-syphilitic leukoplakia buccalis with 9 carcinomas of the tongue.

The evidence for an association between leukoplakia and carcinoma of the esophagus is extremely slight.

Leukoplakia vulvæ is an accepted precancerous lesion, although here again it is impossible to get reliable figures. Berkeley and Bonney, in reporting their personal experience of 58 cases of carcinoma vulvæ, state that they have not yet seen a case in which leukoplakia did not co-exist. Taussig, in a series of 76 cases of cancer of the vulva, noted leukoplakia in thirty-nine. Carcinoma vulvæ is more frequently multiple in origin than any of the commoner forms of malignant disease.

The relation between leukoplakia and cancer of the cervix is less securely founded, and the total available evidence is scanty and unconvincing.

In the urinary tract also the evidence for an association between leukoplakia and cancer is inadequate.

It is concluded, therefore, that leukoplakia linguæ and leukoplakia vulvæ are definitely precancerous lesions, the former usually but not always due to syphilis, with heavy smoking and drinking as auxiliary factors. So far as the esophagus, larynx, cervix uteri, and urinary tract are concerned, an association between leukoplakia and cancer is still unproved.

One of the remarkable features of cancer of the lip is the great difference in its incidence in the two sexes. Of 4,839 cases, 93.5 per cent occurred in males. Another point is the low incidence of cancer of the upper lip, only 5.8 per cent of a series of 3,763 cases. Nearly one-fourth of all cases in women occur on the upper lip. It is believed that the unglazed clay pipe may cause such chronic burning of the lower lip as to lead to cancer.

The importance of prolonged exposure in the open air is stressed by some who find that laborers, merchant seamen, and outdoor railwaymen have an incidence of 200 or 300 per cent in excess of what might be expected. Open-air workers have unrestricted opportunities for smoking, and it is mentioned that the coal-miners working below ground, where smoking is forbidden, contrast with those working above ground in not suffering from excess of lip cancer.

In certain districts of India and the East, betel-nut chewing is a widespread habit, and the incidence of carcinoma of the cheek is extraordinarily high. The betel "quid" is carried in the mouth just opposite the molars, which causes inflammatory thickening and roughening of the mucosa, leukoplakia, and epithelial denudation, followed by progressive ulceration.

Primary carcinoma of the liver is a rare disease in the white-skinned races. In 12,800 autopsies there were only 14 certain cases, or 0.11 per cent. Similar figures have been recorded by other observers. Chinese and Japanese compared to English and American whites have an incidence of 2.21 and 2.18 per cent. Among 91 carcinomas in South African natives, 36 primary cancers of the liver were reported. The hepatic cirrhosis of schistosomiasis has been regarded as a possible factor, and in China, infestation by another fluke has been regarded as a possible factor. Native inhabitants of tropical countries may have repeated and chronic affections of the sources of the portal vein, and this may play a part in the etiology of cirrhosis and cancer of the liver.

There are two main varieties of hepatic carcinoma, the hepatoma and the cholangioma. Liver-cell carcinoma is the commoner.

That cirrhosis of the liver is a precancerous condition is now generally accepted, and the support of this belief comes from figures showing a high incidence of cirrhosis in cases

of primary cancer, and comparative infrequency of primary carcinoma in non-cirrhotic livers.

The author shows that carcinoma occurring in a cirrhotic liver is the end-stage of a well-recognized series of pathologic changes.

Sarcoma of the liver is extremely rare, but there is a certain association of sarcoma of the liver with cirrhosis of the liver.

The author, in discussing hemochromatosis, referred to Rolleston and McNee as to etiology, and in the author's series of cases all 13 showed cirrhosis of the liver.

The author states that, when recognizable, hemochromatosis is invariably accompanied by some degree of hepatic cirrhosis, and might, therefore, be expected to have an association with primary carcinoma of the liver.

After a thorough study of collected series of cases, it is not found possible to attach any significance to the apparently high rate of incidence of primary carcinoma of the liver in hemochromatosis, and the causative factor in both groups is the cirrhosis.

The article is accompanied by numerous tabulations of statistical material.

F. L. GRANDSTAFF, M.D.

Precancerous Lesions of the Alimentary Tract: Lecture II: Cholelithiasis and Cholecystitis. Matthew J. Stewart. Lancet, Sept. 19, 1931, CCXXI, 617-622.

Continuing the Croonian Lectures, the author shows close association between cholelithiasis, cholecystitis, and carcinoma of the biliary passages. In 43 cases of the gall bladder, there were 30 with gallstones, or 69.8 per cent, as compared with 16.4 per cent in a control series of 1,031 gallstone cases in 6,284 autopsies. It was found that carcinoma occurred more frequently when the gallstones were multiple and faceted.

Leitch was able to produce carcinoma experimentally by inserting gallstones into guinea pigs' gall bladders.

Gastric ulcer and its relation to carcinoma is discussed at length. After careful consideration of morbid anatomy and histology, site of the lesion, gastric analyses, and clinical history, it was not possible to state, with any degree of certainty, what proportion of chronic ulcers became malignant. The number is probably small; however, of 109 surgical specimens of carcinoma of the stomach, 17, or 15.6 per cent, showed evidence of having originated in a pre-existing simple ulcer.

In the author's experience, a chronic gastritis of the lesser curvature and pyloric region was common in cases of gastric ulcer, and less common in cases of carcinoma. Gastritis is believed to be a real precancerous lesion, but how often it progresses to malignancy cannot be stated. Chronic duodenal ulcer could not be considered a precancerous lesion, after reviewing the literature and bearing in mind the frequency of chronic ulceration. Carcinoma of the duodenum, in most cases, arises in the peri-ampullary portion, and it is not always possible to determine whether it had its origin in the duodenal mucosa or in the ampulla of Vater.

It was concluded, after reviewing the literature, that diverticulitis has no practical importance as a precancerous lesion.

Carcinoid tumor of the appendix and its association with old inflammatory disease of the appendix is well established. It rarely occurs in the small intestine and when it does so, it is usually multiple.

The lecture is accompanied by numerous statistical tabulations.

F. L. GRANDSTAFF, M.D.

Precancerous Lesions of the Alimentary Tract.—Lecture III: Benign Tumors as Precursors of Cancer. Matthew J. Stewart. Lancet, Sept. 26, 1931, CCXXI, 669-675.

Concluding the Croonian Lectures, the author states that the outstanding example of benign precursor of precancerous lesions in the alimentary tract is the adenomatous polypus of the stomach, colon, and rectum, and the rare condition of "polyposis intestini." There is no evidence that heterotopic tumors are particularly liable to malignant change.

There is scanty evidence of a connection between infestation by animal parasites and

cancer of the alimentary tract in man. There is, however, experimental evidence of such in animals. In inhabitants of Egypt there is a high incidence of bladder carcinoma and a closely associated schistosomiasis.

The author stresses the importance of local factors in the etiology of malignant disease, the need of statistical information of racial and geographic incidence of cancer, and study of the environmental factors of the human race.

F. L. GRANDSTAFF, M.D.

The Combined Electrocoagulation-radium Treatment of Skin Carcinoma. Anton Musger. Strahlentherapie, Sept. 12, 1931, XLII, 143-147.

In 50 cases of skin carcinoma (20 on the nose, 11 on the cheek, 4 in the frontal region, 4 on the lower lip, 3 in the temporal region, 3 in the helix, and 5 on the arm) combined treatment by the endotherm method and radium was carried out. All carcinomatous tissue was first removed and treated by radium immediately, or the next day. Suberythematous doses of from 70 to 80 per cent H.E.D. were applied from 5 to 8 times at intervals of from one to two days. If necessary, this series was repeated from 6 to 8 weeks later. After complete healing of the lesion one or two prophylactic treatments were added.

The end-results of this method were so encouraging that it is recommended as the method of choice. One great advantage of the procedure is the fact that it shortens the treatment period considerably.

ERNST A. POHLE, M.D., Ph.D.

Primary Carcinoma of Bronchus. E. E. Atkin. Jour. Path. and Bacteriol., May, 1931, XXXIV, 343-448.

This study deals with the postmortem findings of 93 cases of primary carcinoma of the bronchus. Of these, 80 were in men and 13 in women.

Microscopically the appearance of the cells varies greatly in different growths and even in the same growth, and there are all stages in the change from the ordinary columnar to the typical squamous cells. The squamous-cell type exhibits a great tendency to necrosis and cavity formation.

Secondary deposits in the lung not affected by the primary growth are uncommon, but in certain cases in which these did occur the author found it difficult to avoid the conclusion that the spread had been by aspiration *via* the bronchi. He found that carcinoma does not appear to arise more frequently in one bronchus than in the other.

Metastases to the abdominal organs occur in the following order of frequency: None, 47; liver, 23; pancreas, 18; kidneys, 14; suprarenals, 12; spleen, 4.

E. C. VOGT, M.D.

CANCER (THERAPY)

The Treatment of Carcinoma of the Cervix Uteri. A. L. Mudaliar. Antiseptic, July, 1931, XXVIII, 499-505.

In the treatment of carcinoma of the cervix uteri the following methods are now employed: (1) Operation; (2) irradiation with X-ray, radium, or both; (3) irradiation and operation. The question of operability is always subject to a diversity of opinions. While at first radiation therapy offered disappointing results in the treatment of these cases, with improved technic and more clinical experience the results have been more satisfactory.

The author briefly discusses the Heyman, Brussels, Paris, and St. Bart's methods of applying radium to the cervix and vagina. He believes that it is advisable to order vaginal douches before and after the application and in those cases in which the radium is left in place for several days. The removal of the radium should be followed by a cleansing douche daily. Manipulation and curettement are not advised in these cases. In the case of the cauliflower growths the cautery has been found useful in removing exuberant tissue.

The contra-indications to irradiation discussed by the author are as follows: Anemia, with a red cell count below 3,000,000; general

emaciation and cachexia; impaired nitrogen metabolism, because radiation tends to increase the blood nitrogen; the presence of inflammatory lesions; complications in the urinary and renal tracts; amenorrhea, and pregnancy. The author believes that Indian patients do not endure large doses of radium as well as Continentals do.

J. N. Ané, M.D.

Carcinoma Therapy with Extremely Hard Roentgen Rays. Erich v. Schubert. Strahlentherapie, Sept. 12, 1931, XLII, 136-142.

In this article the author describes the gamma volt apparatus which has been installed in the Women's Clinic of the University of Berlin. The transformer is built for a maximum output of 600 K.V., but only 400 K.V. and 1 ma. are practical, as it is not possible to run tubes at higher potentials. As filters, 2 mm. of Cu and 2 mm. Al are used at 66 cm. distance, the output being 3.2 r per minute. A number of illustrations show the arrangement of the apparatus and tube. The latter is placed in a room below the treatment room. The patient lies in a lead box which affords ample protection. The ceiling and walls of the apparatus room are covered by 15 mm. of lead. Fans and electric heaters keep the humidity in the engine room from 30 to 40 per cent. After the application of 3,000 r over a single area within 20 days there appears, about five days after the last exposure, a dark red discoloration and intense pigmentation of the skin, followed by necrosis of the epidermis in large pieces. A healthy looking subepithelial layer covered by epidermis appears within 14 days. During the reaction there is moderate pain in the skin. If 4,000 r were applied within 14 days a similar reaction appeared. In spite of the fact that the treatment was given over the lower part of the abdomen there was no irritation of the bladder or the intestines. The leukocytes dropped considerably, particularly the lymphocytes, and there was a marked effect on the tumor.

In closing, the author believes that this expensive and complicated apparatus should be used only in advanced cases with involvement of the parametrium which are treated in other countries by the so-called radium bomb.

Ernst A. Pohle, M.D., Ph.D.

Radiation Therapy of Carcinoma of the Rectum. Ira I. Kaplan. Jour. Am. Med. Assn., Oct. 3, 1931, XCVII, 991-994.

Carcinoma of the rectum constitutes one of the most interesting studies for the radiation therapist, because when a patient suffering from this condition is sent for irradiation, it is usually with a gesture of despair, since the results from treatment of every kind have not been too encouraging.

Cancers of the rectum constitute one-third of all the cancers affecting the body. Rectal cancers stand third in the list of cancers of the intestine causing death. To a limited extent and in a chosen group of cases, surgery offers a very good chance for cure. Usually those referred for irradiation are inoperable. Irradiation can be carried on without colostomy.

A newer method, based on the Regaud principle of small doses of radium applied over a long period of time, is described for applying radium to rectal lesions. A special applicator for the method is also described.

C. G. Sutherland, M.B.(Tor.)

On the Radiophysiology of the Radiotherapy of Cancer. Cl. Regaud. Arch. Radium Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 319-357.

Normal tissues and tissues of human cancers have a common radiophysiology.

There are two kinds of action by rays on mixed tissues:

(1) By direct, violent, and relatively short attack on the most sensitive of their cellular varieties (method of cure of malignant tumors);

(2) By progressive modification of the vasculo-connective stroma (palliative treatment of cancers; treatment of chronic inflammations).

Radiosensitivity is dependent on the multiplication of the germinative cells. Secre-

tory function is antagonistic to radiosensitivity. These facts partly explain the differences in behavior of cancers of the same localization and sometimes of the same origin.

Perfectly selective radiotherapy makes use of a favorable interval between the radiosensitivity of the cancerous tissue and those of the normal tissues, both general and special.

There is a very extensive scale of differences of radiosensitivity among malignant neoplasms. The radiosensitivity of a neoplasm can be artificially modified. The intervention of the time factor diminishes or increases the interval between the degrees of radiosensitivity.

When radiotherapy is fractionated and spread out over a very long time, the interval between the degrees of radiosensitivity is diminished; then suppressed and reversed.

When radiotherapy is fractionated and spread out over a moderate time, there is an increase in the interval between the degrees of radiosensitivity between the general tissues and certain special normal tissues which have rapid renewal (for example, seminal epithelium).

Cancerous tissues behave as does seminal epithelium. From this fact follows the abolition of the massive dose for curietherapy and roentgentherapy of epidermoid cancers at the Radium Institute of Paris.

Between perfectly selective radiotherapy and diffusely caustic radiotherapy, there are intermediate stages which may be used in certain determined conditions.

B. J. De Laureal, M.D.

Review of the Results Obtained Hitherto by my Cure in Cancerous Patients. S. Citelli. Minerva Med., June 9, 1931, XXII, 861-865.

The author advocates the treatment of tumors by subcutaneous injections of extract of the patient's tumor. Such treatment was started in 1914, and the author recalls the various reports he has since presented. He discusses his results at length and compares them with Fichera's, emphasizing the fact that their methods differ widely in principle, although histologic examination ultimately reveals very similar action on neoplastic growths.

L. Marinelli.

Radium and X-ray Therapy in Carcinoma of the Larynx. A. Gunsett. Le Cancer, 1930, VII, 61-82.

This paper is a report on 34 cases, most of which were treated by X-rays, but in the advanced cases radium was applied, either alone or in addition to the X-rays. Hard rays were used, the secondary voltage being 200 K.V., and the filtration not less than 1 mm. of copper. In the later cases the filter was 2 mm. of copper.

The author attaches great importance to the quality of the ray, and states that prior to 1921, when he used a kilovoltage of only 120, with a filter of 5 mm. of aluminum, he had never seen a patient with cancer of the larynx survive longer than a year after treatment. Another technical point which is emphasized is the time over which the treatment is extended. A period of about from 15 to 21 days is recommended. Two lateral fields were employed, each 150 sq. cm. in size, the anticathode-skin distance being 40 centimeters. The dose applied to each field was from 2,200 to 2,500 r. The radium was applied on a moulded apparatus at a distance of 4 cm. and filtered by 2 mm. of platinum. In a few cases needles also were inserted. Of the 34 cases, 10 were intrinsic carcinomas, four of which are reported as cured—one for eight years, one for six years, and two for over three years.

In none of these cases were enlarged glands palpable in the neck. The remaining 24 cases were extrinsic growths, of which four cures of at least three years' duration were obtained. Of these, one remained well for five years and then suffered a recurrence recently. The extrinsic cases were all very advanced and with extensive glandular involvement. It is in these cases that the author recommends radium therapy by external methods, and he gives it as his opinion that only temporary results can be obtained in them by X-ray therapy alone.

Walter M. Levitt, M.R.C.P., D.M.R.E.

The Relative Value of Irradiation and Operation in the Cure of Uterine Cancer. John Osborn Polak. Ohio St. Med. Jour., May, 1931, XXVII, 363-366.

This is one of Dr. Polak's last papers, being the Gilliam Memorial Address before the Columbus Academy of Medicine, on Nov. 17, 1930.

There is still confusion in the mind of the practitioner as to what should be done in the particular case of cervical cancer which he observes. The operable group constitutes only about 10 per cent of the total number of cases seen. By "operable case" is meant one with a growth which is entirely within the confines of the cervix, the uterus being movable, with no detectable parametrial involvement. The other 90 per cent are not operable, can only be treated by irradiation, and do not come into competition with surgery.

"We may state that the superiority of radium over surgery in the treatment of cervical cancer is now generally recognized by surgeon and gynecologist all over the world, with the exception of the three men mentioned in this review (Weibel, Adler, and Bonney), for, if carcinoma of the cervix is diagnosticated in its earliest stages, and radium treatment properly administered, it is possible to cure from 50 to 66 per cent of the cases. Surgical treatment of cervical cancer should be virtually abandoned since better results can be obtained by irradiation and X-ray therapy. The woman is better off with no operation than she is with an incomplete one. In early body cancer her best chance lies in radical operation followed by deep X-ray irradiation."

W. W. Watkins, M.D.

The Treatment of Metastatic Involvement of the Neck Secondary to Intra-oral Cancer. Orville N. Meland. Am. Jour. Roentgenol. and Rad. Ther., July, 1931, XXVI, 20-22.

It is emphasized that all enlarged cervical nodes found co-existing with intra-oral cancer are not necessarily malignant, hence, needling or other form of biopsy is at times necessary to establish the fact of gland extension. In intra-oral malignancies, the author divides his cases for gland treatment into three groups.

Group 1 consists of cases given prophylactic radiation in which no regional metastases can be demonstrated. These patients are given high voltage X-radiation pushed to the point of saturation on the side where metastasis might be expected, with half the dose on the opposite side. If radium is used, it is in the form of a pack, filtered through one millimeter of brass at three centimeters' distance for a total of 6,000 milligram-hours. Group 2 is the surgical group, showing one or more movable, intact, unilateral nodes which are surgically removable. These are first given a thorough course of X-radiation over a period of from three to four weeks; then if no regression takes place, they are given either a radium pack, or electo-surgery is used. If electro-surgical removal of the nodes is done, the edges of the wound are planted with radium needles. Occasionally with only a single node involved, blind needling is done, but this is considered a relatively inaccurate method as compared with electro-surgical exposure. Group 3 is the palliative group which is treated mildly by irradiation to retard progress of the disease, relieve pain, and prevent rapid breaking down of primary or metastatic masses.

J. E. Habbe, M.D.

CATHODE RAYS

Investigations Concerning the Biologic Effects of Cathode Rays. I.—Introduction. B. Rajewsky. Strahlentherapie, Sept. 12, 1931, XLII, 1-5.

II.—The Physical Properties of the Radiation Emitted by a Lenard-Coolidge Tube. W. Gentner. Strahlentherapie, Sept. 12, 1931, XLII, 6-55.

Rajewsky states that the data published so far concerning the biologic effect of cathode rays are not comparable. This is due to the fact that no qualitative and quantitative measurements were carried out. A systematic study of the problem, therefore, seems indicated.

Gentner presents the first part of the study,

i.e., the experiments undertaken for establishing an accurate physical foundation. The apparatus used, including measuring instruments, is described in detail. The cathode-ray tube furnished by Müller was operated on a vacuum pump and tolerated potentials up to 220 K.V. at 4 ma., if the window was well air-cooled. Since the article is rather technical, it may suffice to mention some of the conclusions reached by the author.

He developed a graphic method to determine the speed of the cathode rays outside of the tube. In order to characterize the velocity spectrum of a heterogenous cathode ray beam, he introduces the term "effective velocity" and also describes the method for its determination. A comparison of the figures obtained by that method shows good agreement with the figures published by Lenard. An ionization instrument is also described which permits the determination of the practical length of path of the electrons. The law of Schonland, stating that the product of practical length of path and density is constant for several metals, holds also for air. According to the author's measurements the constant for air used in Widdington's equation is too high, while Wilson's equation agrees well with his own figures. He constructed a concentration coil for cathode rays which permits an increase of the surface intensity of cathode rays in the central ray. Experiments were carried out with this arrangement in order to differentiate the effect of the cathode rays proper and the roentgen rays produced at the tube window. It appeared from exposures of tryptophan solutions that the part destroyed by X-rays was 2.19 times greater than that destroyed by the cathode rays. This shows that the effect of the X-rays produced at the tube window is greater than that of the cathode rays proper. The author also outlines a method which enables one to study the intensity of X-rays produced by cathode rays on various anti-cathodes.

ERNST A. POHLE, M.D., Ph.D.

CONTRAST MEDIA

Researches upon the Opaque Medium Most Innocuous in Arteriography. Guido Oselladore. Minerva Med., Sept. 22, 1930, XXI, 410.

The author has compared the effects of a 25 per cent solution of sodium iodide with those of a 40 per cent solution of uroselectan. The tests were performed on animals and under various experimental conditions. Histologic investigation showed that while uroselectan is perfectly harmless in all cases, sodium iodide produces a definitely harmful action on the capillary system and on the adjacent tissues, especially when circulation of the blood is greatly impaired.

The importance of arteriography in cases of gangrene is illustrated by a clinical example in which radiography very neatly determined the limits of arterial occlusion. The radiologic findings were fully confirmed by dissection.

L. MARINELLI.

The Usefulness of the Different Contrast Media for Intravenous Pyelography. A. Beutel. Med. Klinik, Aug. 21, 1931, XXVII, 1240, 1241.

Three contrast media for intravenous pyelography have been used by the author and he endeavors to evaluate their use. Pyelognost (Roseno), an iodine-urea combination, was tried in eight cases but its use was soon discontinued on account of the lack of contrast and undesirable symptomatic effects. Uroselectan (Binz, Räth, Swick, and von Lichtenberg) was used in 51 intravenous pyelograms. Abrodil (Ossenbeck and Tietze), called "skiodan" in the United States, was also used in 51 cases. Comparison of the results of uroselectan and abrodil showed that both gave satisfactory contrast. Although the price of both drugs is the same, the use of abrodil is less expensive as only one film had to be taken in over half of the cases, whereas, with uroselectan, the pyelograms almost always required two and even three films. The time of preparation and injection is considerably shorter with abrodil. There appeared less reactions from abrodil than from uroselectan. Of the contrast media

available so far, abrodil (skiodan) appears to be more satisfactory in fulfilling the requirements.

H. W. HEFKE, M.D.

CYSTS

Congenital Cysts of the Lung. A. Dethmers. Acta Radiologica, 1931, XII, No. 66, 15, IV, 135-139.

The author presents the case of a woman 34 years old who entered the hospital with a diagnosis of pulmonary tuberculosis. Her general health had always been good, in spite of a cough since the age of five years. She had worked without physical difficulty as a servant and in a factory. Because two sisters had developed pulmonary tuberculosis, she had had her chest examined in 1918. At that time the physician advised a rest cure at home. Unfortunately there was no roentgen examination on this occasion.

In 1920, she went through a normal pregnancy and delivery. In 1923, she had a laparotomy, with removal of one tube and anterior fixation of the uterus. In 1924, under spinal anesthesia, an ovarian cyst was removed. After these operations the patient regained her good general health. Up until the last year before her admission to the hospital she had not had any expectoration, but during this latter twelvemonth she began to raise sputum and had several febrile attacks resembling influenza. Dyspnea also had recently developed.

At the time of admission to the hospital her condition was as follows: No loss of weight or strength, appetite good, pulse and blood pressure normal, no fever, von Pirquet negative, Mantoux positive, Wassermann negative, complement fixation for echinococcus negative, about 60 c.c. of sputum daily, negative for tubercle bacilli. Chest examination showed tympanitic percussion note over the right upper lobe, bronchial breathing, large and moderately coarse râles over the same area.

Films of the chest showed that the whole upper right lobe was filled with irregular, sharply outlined annular shadows, one of which presented a fluid level. The remainder of the chest appeared normal. Lipiodol was administered under fluoroscopic control. Films made at this time showed lipiodol in numerous cavities throughout the right upper lobe. Very fine reproductions of these two sets of chest films illustrate the article.

The author feels that there was no foundation at all for the diagnosis of pulmonary tuberculosis and that the history and negative laboratory findings rule out echinococcus cysts and bronchiectasis localized in the right upper lobe. He regards the case as one of congenital cysts of the lung and reviews briefly the cases reported in the literature, most of which have been diagnosed only at autopsy.

A. L. HART, M.D.

Suprahyoid Dermal Cyst Implanted in the External Auditory Meatus. Atilio F. Parodi. Prensa Méd. Argentina, Aug. 20, 1931, XVIII, 359, 360.

This case is here presented because of the unusual site of the cyst. Only one other case has been reported in the literature. The patient is a girl 14 years old, who, a few months after birth, presented a lump in the left submaxillary region. This remained about the same size until the first menstrual period, when it started growing rapidly. The cyst was injected with lipiodol and radiograms were taken. Finally, it was dissected *in toto*.

N. G. GONZALEZ, M.D.

DIATHERMY

Influence of Diathermy of the Thyroid Gland on Basal Metabolism. J. Jankowski and L. Ptaszek. Compt. rend. soc. de biol., 1930, CIII, 425-427; Physiol. Abstracts, XV, 315.

Diathermic treatment of the thyroid gland caused an increase of basal metabolism which was parallel to the improvement of symptoms. The reaction of the organism to this stimulus has the character of an endocrino-vegetative reflex. In the first phase there is excitation of

the sympathetic. At first there is a fall of basal metabolism and then an increase. During the fall, the organism does not react to a fresh diathermic application. The application should only be renewed when the effects of a previous one have passed off. The variations of basal metabolism are not parallel to the modifications of other symptoms or to variations of the subjective state of the invalid.

CHEMICAL ABSTRACTS.

Diathermy in Acute Inflammatory Conditions. B. N. C. Roy. Antiseptic, July, 1931, XXVIII, 540-544.

The high voltage used in diathermy results in the current passing along a direct path between electrodes. Those tissues which are situated between the electrodes are heated so rapidly that it is impossible for the circulatory system to equalize the temperature immediately. An acute temporary dilatation of capillaries occurs which results in acceleration of the circulation of the blood in the deeper tissues. This facilitates the cellular interchange of gases and fluids and an increase in local resistance. The temporary dilatation is followed by contraction, which restores the tone to lymphatics and capillaries. Diathermy raises the body temperature to some extent and lowers both systolic and diastolic blood pressures.

We depend upon the leukocytes and the immune bodies for a healing process. Anything which helps in attracting and concentrating these agencies in the affected tissues will, therefore, aid in the healing. Consequently, what is required is some special means to make the area more approachable and permeable by the formation of new capillaries, allowing more passage of blood. Diathermy properly applied is believed by the author to accomplish this admirably.

J. N. ANÉ, M.D.

DOSAGE

The Diversity of Reactions of Tissues Treated by X-rays, Including the Time Factors and the Relations of the Dosimetrical Biology in the Radiotherapy of Malignant Tumors. Cl. Regaud and R. Ferroux. Arch. Radium Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 293-318.

Following considerable experimental work, the authors come to the following conclusions:

(1) The sterilization of seminal epithelium by X-rays, be it partial or total, is irreparable.

(2) It is impossible to sterilize the testis of the rabbit by a single irradiation, without the production of radiolesions of the skin, often fatal and always the cause of cachexia.

(3) The massive dose which causes severe radiolesions of the skin is between 4,000 and 4,400 Solomon R units.

(4) If the X-radiation is produced under high tension (180 K.V.), the changes of filtration between 0 and 8 mm. of aluminum modify very little the relation between the ionometrical dose and the greatest biologic phenomena.

(5) When the distribution of the rays is spread out over a longer time, the threshold dose for radio-necrosis increases proportionately.

(6) On the contrary, the radiolesions of the seminal epithelium are not diminished by the lengthening—up to a certain limit—of the time of treatment, the doses remaining equal.

(7) This discordant behavior of the tissues allows the destruction of all the spermatogonia, with the production of serious lesions of the skin.

(8) For a dose of about 5,000 R the optimum arrangement of the time factor appears to be obtained by the equidistant distribution of four or five equal fractions in from four to nine days.

(9) Radiotherapy gains greater selectivity when the dose is fractionated and spread out.

(10) Is the dose necessary for sterilization increased, maintained, or diminished by being fractionated and spread out? This question remains unanswered.

(11) The analogy between the behavior of the germinative spermatogonia and certain cancerous tissues has led the Radium Institute of Paris to prefer, for the treatment of

epidermoid cancers of all localizations, radiotherapy prolonged over a definite time to massive radiotherapy. The improvement of the therapeutic results has confirmed the correctness of this opinion.

(12) The biologic effects have no dosimetric significance independent of the time and can not serve to define absolute doses of radiation.

(13) The conclusions relative to the relations between the doses and the thresholds of biologic effects have fixity only for the qualities of radiation which are effectively utilized.

B. J. De Laureal, M.D.

The Fractional X-ray Dose. H. C. Menkel. Antiseptic, July, 1931, XXVIII, 523-525.

Holzknecht, Sabouraud, Bordier, and others, for a considerable time, were in favor of the massive dose unit in the application of X-ray therapy. In the last few years, however, there has been some reversion to the smaller dose and more frequent exposures. Holzknecht definitely abandoned his advocated massive dose and adopted the fractional dose technic. Experimental work has shown that more striking results have been obtained in the destruction of malignant tissue by the use of smaller and more frequent doses than by the application of a single massive dose. It has also been shown in humans that tumors which no longer reacted did so when the dose was distributed over several days. The theory rests on the fact that division of cells ceases immediately after irradiation, this condition persisting for several days, when division again occurs. The cells at the time of division are particularly sensitive to the X-rays and if one is fortunate to again irradiate at the proper time, the effect is from two to three times as great as when the total dose is given in one sitting.

The author concludes that biologic experiments have indicated along what lines the future treatment of cancer should progress. There is no doubt but that X-rays produce results and that correct technic is essential, but it is the knowledge of the pathology of cancer which will lead the way to the proper treatment of this disease. It should be remembered that cells are most susceptible to the influence of the X-rays at the stage of transition or mitosis. It is likewise essential to bear in mind that it is the absorbed rays which produce the desired therapeutic effects.

J. N. Ané, M.D.

THE ESOPHAGUS (DIAGNOSIS)

Epithelioma of the Esophagus in Association with Achalasia of the Cardia. Geoffrey Rake. Lancet, Sept. 26, 1931, CCXXI, 682, 683.

As a result of achalasia there is intermittent irritation of the esophagus. The condition of epithelial hyperplasia often occurs with production of definite papillomas. As irritation continues, these become malignant. In fifteen fatal cases, three deaths were due to malignant growths from ulcerated areas, resulting in cases of achalasia.

Prophylaxis consists of diet and a régime, as advised by Hurst, and emptying of the dilated esophageal sac by mercury bougie. Cases having papillomatous growths should have a periodic esophagoscopic examination.

F. L. Grandstaff, M.D.

Roentgen Diagnosis of Varices in the Esophagus. R. Hjelm. Acta Radiologica, 1931, XII, No. 66, 15, IV, 146-151.

The author first discusses the cause of esophageal varices. The portal vein drains the stomach, intestine, and spleen. Any obstruction in the portal vein causes congestion, which, in turn, results in dilatation of the anastomotic vessels. The collateral splenic veins are small and poorly developed, the most important of them coursing through the gastrosplenic and splenophrenic ligaments and emptying into the lower esophageal veins. These esophageal veins also act as collaterals for the stomach veins. Hence, in portal obstruction these veins frequently become greatly enlarged, even reaching the size of a lead

pencil. These varices are covered by only a thin layer of connective tissue. Their danger lies in their tendency to bleed. The upper esophagus may be affected similarly in obstruction of the superior vena cava.

There are three important causes of portal obstruction with varicosities in the esophagus: (1) Cirrhosis of the liver; (2) syphilis of the liver; (3) portal thrombosis. The clinical diagnosis of esophageal varices is extremely difficult. The patients have usually been thought to have peptic ulcer. Only a few cases diagnosed at roentgen examination have thus far been reported, but, no doubt, as the technic improves more cases will be found antemortem.

The author reports the two following cases.

A woman of 48 years had vomited blood on several occasions. The clinical diagnosis was peptic ulcer. Ordinary roentgen examination of the stomach showed medial displacement of the fundus and pars media by an enlarged spleen but no other pathologic changes in stomach or duodenum. The esophagus was then examined with both thin and thick opaque material. Films made while the barium mixture was passing through the lower esophagus showed semicircular filling defects irregularly scattered through the esophagus, while films made after the barium had passed into the stomach showed remnants of the opaque material lodged in the grooves and about the edges of the filling defects. At autopsy large varicosities were found in the lower esophagus and the fundus of the stomach, and, in addition, cirrhosis of the liver, subacute hepatitis, and cholelithiasis.

A man of 47 years had ascites. Examination of the esophagus showed the same appearance as in the first case. Autopsy was not obtained in this patient.

A. L. Hart, M.D.

THE ESOPHAGUS (THERAPY)

Surgical Treatment of Idiopathic Dilatation of the Esophagus. Henri Oberthur. Arch. d. mal. de l'app. digestif, June, 1931, XXI, 649-679.

A simplified surgical procedure is offered for the relief of idiopathic lower esophageal dilatation. Two cases are presented, both permanently relieved by this benign and efficacious method which is a modification of Heller's and Wendel's methods. It consists of an extra-mucus esophagoplasty through the upper abdominal route. The left triangular ligament is cut, allowing more freedom to the liver and better exposure of the cardia. The peritoneum is then cut at its reflection on the diaphragm and the esophagus. The small omentum is split along the right side of the esophagus, exposing it and the diaphragmatic opening. Posteriorly it is freed from the meso-esophagus with the fingers. With curved closed scissors and tampons it is further freed from the diaphragmatic pillars and pulled down from eight to ten centimeters. The muscularis is incised anteriorly and vertically beyond the entire length of the contracted area.

Radiologically the results are perfect, the dilatation diminished considerably, and the passage of food unobstructed. The etiology is discussed and the author believes the mechanism to be a primary dilatation rather than a congenital defect. This is followed by local irritation and stasis, the contributing factors being insufficient mastication, poor dentition, alcoholism, spices, badly prepared and heavy foods. This eventually leads to a cardiospasm and inflammatory stenosis. Medical treatment has never cured a cardiospasm, and dilatation methods are frowned upon as being dangerous and giving but fair results.

B. J. De Laureal, M.D.

EXPERIMENTAL STUDIES

The Biologic Study of Radiosensibility. Part I.—The Effect of X-rays upon the Immature Tissues of Plants. J. Nakagawa. Japanese Jour. Obstet. and Gynecol., June, 1931, XIV, 218-224.

Experiments have proved that small doses of X-rays stimulate germination, while large doses inhibit this function. There is likewise some difference of opinion regarding the formation of X-ray tumors and the generation of monsters following strong irradiation. Assuming that the process of the formation of

such conditions is better studied in the immature tissues of plants, the author irradiated the seeds of the *Vicia faba*. From ⅓ E.D. to 6⅔ E.D. were administered after the seeds had been steeped in water and sown in saw-dust. At a definite time following irradiation the seeds were fixed in paraffin and serial sections were made and examined. These were compared to normal non-irradiated seeds prepared in a similar manner.

The experimental results summarized were as follows:

(1) Strong and medium irradiation produced the same biologic changes.

(2) The development and growth of the root were disturbed and the tip had the appearance of permanent tissue.

(3) The most marked changes were observed at the vegetation point, which was abundant in immature cells, and which showed after irradiation many multinuclear giant cells.

(4) The earliest and most marked changes appeared in the nuclei of the cells, which showed the greatest swelling, shrinkage, and destruction from three to five days after irradiation.

(5) Mitosis was rarely observed and, when seen, appeared irregular and asymmetric.

(6) The changes in the cytoplasm were observed relatively later and consisted of the appearance of granules and large vacuoles.

(7) The cell bodies showed marked swelling and inequality in form and irregularity in arrangement.

The radiosensibility of plant tissue was found to differ markedly. Generally, it may be considered that the more immature the cells, the more vivid the reproduction, and the more persistent the mitosis, the greater becomes the radiosensibility, as was demonstrated by Bergonié and Tribondeau. The author concludes that the irregular arrangement of plant cells and the formation of deformity result after strong irradiation because of the difference in radiosensibility of the individual cells.

J. N. Ané, M.D.

Short Roentgen "Interferenzaufnahmen"—a New Method for Physiologic Investigation. Gundo Boehm. Ztschr. Biol., 1931, XCI, 203-214.

The physiologic swelling of resting muscle is due to the over-infiltration of water between the micellæ. Isotonic contraction leads to their deformation, which results in interference points in the roentgenograph.

Chemical Abstracts.

Investigation of the Histologic Change in Plant Shoots Caused by X-rays: Especially the Effect upon the Arrangement of Tissues in the Seed of Vicia Faba. K. Narimatsu. Japanese Jour. Obstet. and Gynecol., February, 1931, XIV, 50-57.

Using the seeds of *Vicia faba*, the author studied the effects of the X-ray upon cell arrangement. The dry seeds were soaked in water for from 24 to 48 days before irradiation, then sowed upon a moist saw-dust bed and allowed to send out the principal roots. Those which had sprouted were then placed upon a level glass dish, which was covered with white paper to prevent the seeds from being dried and killed. The dish was then so placed under the X-ray tube that irradiation was evenly distributed. The factors employed were as follows: 140-150 K.V.P.; 2 ma.; distance 17-20 cm.; duration, 15-60 minutes; no filter; shortest wave length, estimated by the Mark IV spectrometer of Marsch, Stauning, and Fritz, 0.084 Å.E.–0.092 Å.E.

The irradiated seeds were sown upon a moist saw-dust bed and from three to nine days later were fixed by Flemming's method, Boan's liquid, or formalin solution. Then a series of paraffin specimens were made and stained with hematoxylin eosin, lithion carmine, and by Flemming's solution.

Examination of the sections of the seeds which had received weak irradiation showed no marked abnormality in the cell arrangement as compared with the non-irradiated group. The most marked changes were produced in the nuclei of the cells. Mitosis decreased, the boundaries of the nucleus became indistinct, and the shape of the nucleus changed. In some cases the nucleus was so completely atrophied that the cell-body appeared as if it consisted of protoplasm devoid of a nucleus.

In the group which had received medium irradiation the degenerative changes in the nuclei and swelling of the cell bodies were more marked. In the strongly irradiated group the swelling of the cell bodies was marked, those lying together appearing as if sutured, and the arrangement of the cells presented evidence of abnormality.

The degree of disturbance observed by the author in these experiments was not proportional to the amount of irradiation. This is explained by variations in sensitivity of the individual cells constituting the tissues in the seeds. In this experiment it was also observed that the deeper layer of cells was more markedly affected than the outer layer. This was due to the fact that the sensitivity to X-rays was greater in the deeper layer of cells, in which mitosis was more marked. It was noted also that the first evidence of the effects of irradiation was observed in the chromatin of the nucleus. The author believes that the abnormality in arrangement of the cells is not the immediate effect of irradiation but is secondary to the degenerative changes in the nucleus and cell-body, due to X-rays.

J. N. Ané, M.D.

Tumor Immunity: The Effects of the Eu- and Pseudo-globulin Fractions of Anti-cancer Sera on Tissue Cultures. Thomas Lumsden. Jour. Path. and Bacteriol., May, 1931, XXXIV, 349-355.

The author had previously developed an anti-cancer serum by inoculating cancer of one species (*e.g.*, man) into a heterologous animal (*e.g.*, sheep). When this was applied to tissue cultures of normal and malignant cells taken from an animal of yet another species (*e.g.*, mouse or rat), the malignant cells were killed in a few minutes while the normal cells survived and continued to grow. When, however, a sublethal dose of such serum was inoculated into the general circulation of a cancerous mouse or rat the cancer was little, if at all, affected. The reason for this was that the anti-cancer serum became too much diluted by the body fluids.

Only by stopping the circulation in the tumor and injecting the serum was it possible to repeat *in vivo* the results obtained *in vitro*. After successful treatment of an implanted tumor, the cured animal became highly resistant to subsequent implantation of tumor cells.

It was later pointed out that the serum of an animal frequently inoculated with fragments of heterologous cancer contains three factors toxic to the cancer which was used as an antigen:

(1) Heterotoxin which is lethal to all heterologous cells. This is normally present in the serum of untreated animals.

(2) Anti-malignant-cell bodies having a specific affinity for cancer cells.

(3) Anti-species bodies lethal to normal as well as malignant cells of the species from which the cancer used as an antigen was taken.

By fractioning anti-cancer serum, the heterotoxins and anti-species bodies can be removed or destroyed, so that the resultant euglobulin fraction is ten times less toxic to mice, although it has lost none of its toxicity to the cancer cell.

It is considered that these experiments demonstrate beyond reasonable doubt the existence of anti-bodies having a specific affinity for cancer cells.

E. C. Vogt, M.D.

Comparative Investigations on the Effect of Bucky and Roentgen Rays on Cell Division. G. Politzer and J. Zakovsky. Strahlentherapie, Sept. 12, 1931, XLII, 165-170.

Salamander larvæ, about fourteen days old, were placed in small glass dishes on moist filter paper. Then the larvæ were exposed to Grenz rays at 10 cm. distance. Every three minutes they were rinsed in cold water in order to prevent changes due to increased temperature. The tube was operated at 10 K.V. and 10 ma., the duration of exposure varying between five and twenty minutes. The output of the tube was 150 r per minute.

Histologic studies of the irradiated larvæ

showed that Grenz rays produce exactly the same injuries on cell division as ordinary roentgen rays. It is concluded, therefore, that any difference in the therapeutic effect of Grenz rays cannot be due to any specific action but must be explained on the basis of the absorption law.

ERNST A. POHLE, M.D., Ph.D.

Investigations on the Bactericidal Action of Tissues of Healthy Animals and Those Radiated with X-rays. G. M. Antonioli. Strahlentherapie, 1931, LXI, 496-509.

The author concludes the following: A weak irradiation of guinea pigs with X-rays increases the bactericidal action of tissues and organs. An intensive irradiation of guinea pigs by strong and frequent doses of X-rays causes a considerable decrease in the germicidal power as compared to the control animals. These biologic changes of the action of X-rays are limited to the reticulo-endothelial cells. The difference of the germicidal action of various tissues and organs of radiated and non-radiated animals can only be explained by the uneven distribution of the reticulo-endothelial system in the animal tissues and organs. The author's experiments prove that small doses of X-rays influence the germicidal action of the reticulo-endothelial system favorably. Large doses, however, react most unfavorably.

CHEMICAL ABSTRACTS.

Measurement of the Amount of Mesothorium and Radiothorium in Encapsulated Preparations of Radium. Rolf M. Sievert and Ernst Olsson. Acta Radiologica, 1931, XII, No. 66, 15, IV, 121-134.

Because the use of very large quantities of radium salts is becoming more and more common in medical practice, it is important to develop a method of measuring the amount of mesothorium and radiothorum in these preparations of radium. The authors of this paper have worked out such a method, based on principles earlier described by Bothe and by Hahn. It is based on the variation in the absorption of the gamma-rays from Radium C, Mesothorium II, and Thorium C by lead filters of different thickness. It can be used without opening the radium container.

The authors describe in detail their experimental work and the various preparations of radio-active substances measured and used as standards. Tabulations and graphs showing the absorption coefficients of the several radio-active substances studied are incorporated in the paper.

These methods may be used in: (1) The determination of the mesothorium content of freshly made preparations containing both radium and mesothorium; (2) the determination of the amounts of radiothorium and mesothorium in such preparations (provided that the quantity of radium present is known) and of the approximate age of these preparations, and (3) the determination of the radium content when the proportion of the radiothorium to the mesothorium is known, *e.g.*, from the age of the preparation. The accuracy of these measurements is greatly influenced by the age of the preparations, but the method is nevertheless usually reliable for detecting any considerable amounts of mesothorium and radiothorium.

A. L. HART, M.D.

THE EYE (DIAGNOSIS)

The Effect of Roentgen Irradiation of the Sympathetic Nerve upon the Eye. Hans Salinger and Rudolf Thiel. Strahlentherapie, Sept. 12, 1931, XLII, 96-112.

In order to study the response of the sympathetic nervous system to roentgen rays, the authors exposed the ganglion cervicale supremum and the centrum ciliospinale in patients with and without increased intra-ocular pressure. The technic for the irradiation of the ganglion cervicale supremum was as follows: The central ray was directed perpendicular over the center between the angle of the jaw and lower margin of the auditory canal. One-third H.E.D. was applied on the skin (170 K.V., 4 ma., 0.5 mm. Cu, 30 cm. F.S.D.). The exposures were given at eight-day intervals not more than three times. The

intra-ocular pressure was determined with the patient prone on the treatment table before irradiation and immediately afterwards—later at certain intervals. The tonometer of Schiötz was used. The exophthalmos was measured by means of the exophthalmometer of Hertel, while widths of the pupil and the interspace between the lids were determined by the keratometer of Wessely.

In patients with glaucoma the pressure curves of both eyes showed a very characteristic appearance following unilateral irradiation of the ganglion cervicale supremum and the centrum ciliospinale. Following a preliminary increase, there was a definite drop in the pressure lasting several days and being followed by a gradual increase. The curves in both eyes run parallel, *i.e.*, the pressure of the eye on the non-irradiated side changes identically with that of the eye on the irradiated side. In persons with normal eyes the fluctuations were very small. Protrusion of the eye bulb, dilatation of the pupils, and increase of the interspace between the lids were observed and considered as symptoms of sympathetic stimulation. The authors believe that their observations can be considered as proof of the effect of roentgen rays on the vegetative nervous system.

ERNST A. POHLE, M.D., Ph.D.

Radiography of the Optic Canals. R. Cassou. Bull. et Mém. de la Soc. de Radiol. Méd. de France, May, 1931, XIX, 225-229.

The author has developed a technic for easily and repeatedly demonstrating the optic canals. He finds that the average inclination of the optic canals lateralward from the sagittal plane of the head is from 30 to 35° and the caudal inclination is 15° through a horizontal plane passing through the glabella of the forehead.

The optic canals are situated intracranially at the summit of the orbital pyramid; they must be oriented and radiographed separately. The central ray must be projected in the central axis of the optic foramina.

The patient is placed prone on a table, the glabella and nose in contact with the film; the tube is inclined lateralward 30° and caudalward 15° from the midpoint of the glabella. An exposure is made, the film changed; the tube is then shifted to the opposite side of the head and an exposure made of the opposite optic canal. The author suggests a focus film distance of 60 cm., and a small cone of X-rays.

CHARLES S. CAPP, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Observations of Clinical, Anatomic and Radiologic Natures in a Case of Chronic Ileocecal Invagination of the Colon. S. Famulari. Minerva Med., Nov. 3, 1930, XXI, 643-649.

This article is essentially a description of a case of ileoceco-colic invagination. The author draws from this study the following conclusions:

(1) The clinical signs of invagination are not always present at the beginning of the process.

(2) Its symptomatology may be very similar to that of other intestinal diseases.

(3) Its duration may be protracted over a long period of time during which signs of an apparent cure may arise.

(4) A neglected chronic invagination always results fatally.

(5) It is possible to reconstruct chronologically the different stages in evolution of an invagination only through accurate studies of clinical, anatomic, and radiologic nature.

L. MARINELLI.

Fixation of the Iliac Colon by Acquired Bands: Radiological Demonstration. Alfred C. Jordon. British Jour. Radiol., August, 1931, IV, 387-390.

The author believes it possible, by barium enema study, to demonstrate the rather frequent occurrence of acquired bands about the iliac colon. These he considers are the result of constipation. As bands form, the mobility of this part of the colon is restricted, stasis,

inflammation, and narrowing occur, and the results are stasis and dilatation in the proximal colon. The author states also that the abnormal fixation of the iliac colon is a primary factor in the causation of gastric and duodenal ulcer; also that the colon stasis is a factor in the causation of carcinoma of the bowel.

Evidence of band formation consists in showing a delayed filling of the iliac colon, with over-distention of the rectum and pelvic colon. The meal finaliy trickles through the fixed iliac colon and into the descending colon, the latter part showing dilatation with the iliac colon narrowed. The enema can is then lowered and delay in emptying of the barium from the bowel above the pelvic colon is seen. Apparently, therefore, the diagnosis of bands and kinks rests more on the demonstration of stasis than on lessened mobility.

J. E. HABBE, M.D.

Heterotaxia and Incomplete Transposition of Viscera. Isaac Natin. Semana Méd., June 19, 1930, XXXVII, 1560-1570.

Two cases, one of heterotaxia and one of incomplete transposition, were attended by the author, the first one seeking treatment because of pulmonary tuberculosis and the second one because of typhoid fever. The first case had a total transposition as proven both radiologically and at autopsy. In the second case, transposition of the heart, spleen, liver, and stomach was found. The colon, as seen radiologically, did not present any transposition but showed slight deviation from the normal. Neither case had any symptoms referable to its malady. The anomalies of these two cases were found accidentally, and the author presents them because they comprise rare conditions.

N. G. GONZALEZ, M.D.

Marked Gastro-intestinal Hyperthyroidism: Report of Thirty-four Cases. J. Russell Verbrycke, Jr. Jour. Am. Med. Assn., Aug. 22, 1931, XCVII, 513-517.

The thyroid can play an important part in the production of gastro-intestinal symptoms without giving the usual thyroid syndrome and without demonstrable enlargement of the gland.

Thirty-four cases recognized in a period of three years are analyzed, and four individual case reports are reviewed.

Phenobarbital and compound solution of iodine, as medication, with advice as to rest, diet, mental attitude, and other therapeutic measures, were sufficient in the majority of patients. Nine of eleven treated by radiation were either greatly improved or apparently cured.

C. G. SUTHERLAND, M.B. (TOR.)

X-ray Findings in the Gastro-intestinal Tract. Julius Gorfinkell. Med. Bull. Veterans' Administration, September, 1931, VII, 845, 846.

The author discusses briefly the X-ray examinations of the gastro-intestinal tracts of ex-service men and the pathologic conditions most frequently observed in this group of patients.

With the exception of one case of esophageal stricture, no pathologic condition was encountered in the esophagus. Duodenal ulcer was the most frequent finding in the stomach and duodenum. Gastric ulcer and gastroenterostomy were also quite common. One case of the author's series showed evidences of both ulcer and newgrowth formation. A frequent finding in the colon, which was observed in from 80 to 90 per cent of cases, was a spastic colon, usually seen in the transverse and descending segments.

J. N. ANÉ, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

Calculous Obstruction of the Ureter—Observations Based on an Experience of 120 Cases. W. Calhoun Stirling. Urol. and Cutan. Rev., September, 1931, XXXV, 547-551.

The author divides calculous obstruction of the ureter into the following classes: Those in which impaction is partial, and those cases

in which the ureter becomes completely blocked. While complete obstruction may or may not result in dilatation and infection of the kidney pelvis, intermittent obstruction with its resultant renal back pressure frequently produces complete destruction of the kidney.

The four most commonly accepted causes of the formation of kidney calculi are as follows: (1) Bacteria; (2) colloidal imbalance; (3) vitamin deficiency; (4) urinary stasis. The salts of uric acid and urates have been found to constitute about 75 per cent of the stones removed. Calcium oxylate and the phosphates occur in smaller proportions. The opacity of a stone depends on its atomic weight. The 5 to 10 per cent error in ureterography is made up by the uric acid, cystin, and similar stones which cast no shadow. Occasionally a stone will be superimposed on the bony pelvis and be overlooked.

Approximately 75 per cent of calculi become impacted in the lower ureteral segment, 15 per cent in the upper ureter, and the remainder in the iliac portion. In the author's series stones were found in both ureters in 8 per cent and recurrences resulted in 5 per cent.

Pain was the outstanding symptom in 89 per cent of cases in this series. Nausea and vomiting were present in 29 cases and were reflex in origin. Hematuria occurred in 53 cases of the author's group. The preliminary routine roentgenogram frequently showed many small opaque shadows near the ureteral orifice which usually represented calcified glands. In cases presenting symptoms it is advisable to pass an opaque catheter to positively identify these small shadows, and if further confirmation is desired a ureterogram may be done.

The treatment of ureteral stone depends upon the following factors: The size, shape, number, and location of the stones; amount of renal infection; the function; duration of impaction; tolerance to cystoscopic manipulation; the age and general condition of the patient; amount of pain, and the degree of fever. The author believes that wherever possible conservative treatment should be tried first.

J. N. Ané, M.D.

Strictures of the Ureter. W. Mulvehill. Am. Jour. Surg., August, 1931, XIII, 256-262.

The author believes stricture of the ureter to be present more frequently than some writers claim. He is of the opinion that there are various stages in the pathology of stricture which may render it difficult to diagnose.

The end-results of ureteral stricture may be: (1) Essential hematuria; (2) hydronephrosis; (3) pyonephrosis; (4) pyelitis; (5) urinary calculi; (6) some medical nephritides, and (7) much of the pathology in congenitally malformed kidneys and many so-called bladder neuroses. The etiology is due to the common pyogenic organism. No case of gonococcus infection as the cause was demonstrated in this study.

Hunner does not believe inflammation of the tubes and ovaries plays a part in ureteral stricture. Scott Pugh states that while seminal vesiculitis may be a cause of ureteral obstruction it is never the factor in the formation of ureteral stricture.

The author contends that most cases, not considering trauma, are due to hematogenous infection from distant parts of the body.

The symptoms are chiefly dull aching, vague pain, backache, and frequency. Bladder symptoms are entirely absent in 30 per cent of the cases.

In the author's hands, the "hang" of the ureteral catheter has not met with much success in making a diagnosis, nor does obstruction to the introduction of a catheter mean stricture of the ureter.

The most reliable method employed is pyelography. Intravenous urography has met with the writer's favor in diagnosing ureteral stricture. He believes that the dilatation below a stricture in the ureter may be due either to the improper filling with opaque solution at the time of pyelography or to the impairment of nerve supply of the ureter caused by the scar tissues of the stricture, and resulting in atony of the ureter.

The treatment of ureteral stricture consists of dilatation. He advocates the continuation of this procedure as long as the pain recurs and is relieved by dilatation. Approximately

50 per cent of the author's patients were cured, and great relief, for some time at least, was reported in a far greater percentage.

In the discussion which followed, Ferrier believed the author to be a little too enthusiastic in regard to the diagnosis of strictures of the ureter. He states that spasm and kinking very often simulate a stricture so that it is frequently necessary, in order to be absolutely certain that one is dealing with a stricture, to take one or two successive roentgenograms to prove that it is consistent and uniform in type, size, and shape.

DAVIS H. PARDOLL, M.D.

Contribution to the Roentgen Diagnosis of Internal Biliary Fistula. Gösta Gråberger. Acta Radiologica, 1931, XII, No. 66, 15, IV, 164-174.

The author reviews the cases of spontaneous biliary fistulæ reported in the literature. He states that fistulæ between the bile passages and other organs have been recognized for more than a century and that they have been reported as connecting the biliary tract with the stomach, duodenum, colon, appendix, pleura, pericardium, urinary passages, and uterus. Until the last fifteen or sixteen years, diagnosis was usually made at autopsy.

This condition is not common. Roth. Schroeder, and Schloth reported only 43 cases of internal biliary fistula in 10,866 autopsies. Of these, 19 were between the gall bladder and duodenum and 16 were between the gall bladder and colon. The same relative frequency was found by Courvoisier and Naunyn and by Judd and Burden.

The commonest cause of internal biliary fistula is gallstones. Less frequent causes are: (1) Gastric or duodenal ulcer; (2) carcinoma of the stomach; (3) carcinoma of the gall bladder; (4) cholecystoduodenostomy, cholecystenterostomy, or cholecystogastrostomy, and (5) chronic cholecystitis. Most of these fistulæ, however, are late complications of cholelithiasis.

X-ray diagnosis of these fistulæ depends on the presence of gas or barium, or both, in the biliary tract. It is possible, however, for barium to pass through the papilla of Vater into the bile ducts when a fistula does not exist. Filling of the ducts with barium in this way has been reported in eight or nine cases of chronic pancreatitis and in obstruction of the jejunum by pressure of a large gastric carcinoma.

The author describes a case of chronic gall-bladder disease in a woman 70 years old. At X-ray examination a fleck of barium was observed outside the duodenal cap in the gall-bladder region; as the barium distended the cap, the fleck became larger. After a few minutes the cap was seen to expel most of its contents back into the duodenum. Cholecystography, done a few days later, showed, instead of dye in the gall bladder, a collection of gas.

The article is illustrated by several excellent reproductions of films in which either barium or gas is seen in the gall bladder or biliary ducts.

In the ensuing number of *Acta Radiologica*, the author has a note on another case which showed gas and barium, apparently in the gall bladder. Cholecystography showed no visible gall-bladder shadow. When the stomach was examined, fluoroscopy showed barium and gas passing into the gall-bladder area. After three hours, when the stomach was empty, barium was still visible in the gall-bladder region; after 24 hours the gall bladder was empty. At operation a diverticulum from the lateral wall of the duodenum was found in the angle between the common duct and the duodenum.

A. L. HART, M.D.

GENITO-URINARY TRACT (THERAPY)

Intravenous Urography. Hermon C. Bumpus, Jr. The Journal-Lancet, Jan. 1, 1931, LI, 10-13.

It is doubtful if, however much the patient might so desire, urography after intravenous injection can replace cystoscopic examination except in individual cases. The amount of

infection in each kidney, determination of separate renal function, and condition of the vesical mucosa, are frequently indispensable. The greatest field of usefulness for intravenous urography is that in which the presence of a second kidney is in doubt, because only one ureter can be found by cystoscopic examination, or injection of one ureter is prevented by stone or stricture.

The determination of functional excretion of the dye is, at present, uncertain. Good visualization occurs not only as the result of good function but is also secondary to renal retention; on the contrary, many normal cases give very imperfect visualization. The causes of these confusing observations have not been fully determined.

W. W. WATKINS, M.D.

Use of Intravenous Uroselectan in Trauma of the Urinary Tract: Report of a Case of Ruptured Kidney. Ben Earle Fillis. Urol. and Cutan. Rev., September, 1931, XXXV, 567, 568.

The author reports a case of ruptured kidney in which uroselectan was found valuable in diagnosis and in eliminating peritoneal rupture of the urinary bladder.

The patient, 16 years of age, in moderate shock, with symptoms of chilliness, hematuria, nausea, vomiting, and severe pain in left renal and bladder areas, was admitted to the hospital. The history was that of trauma resulting from a hard tackle during a football game four hours previous to admission. Examination at the hospital revealed the following: temperature, 98.4 degrees; pulse, 90; respiration, 20; tenderness of the left upper and lower quadrants of the abdomen, with moderate rigidity of the lumbar and abdominal muscles in this region. Urinalysis revealed bloody urine, with albumin, and red and white blood cells. Blood examination showed a leukocystosis.

The patient was treated for shock and then administered uroselectan intravenously. The resulting urograms revealed a normal right kidney pelvis and vague left renal pelvis. The cystogram was normal and cystoscopy was negative, except for the ejection of bloody urine from the left ureteral orifice. Indigo carmine, injected intravenously, appeared at the right ureteral orifice six minutes after injection. A diagnosis of complete rupture of the left kidney, with extra-renal and intrapelvic hemorrhage was then made and the patient was given expectant treatment, with frequent blood and urine examinations serving as guides. The subsequent course was uneventful, and the patient, without pain but not entirely free from hematuria, left the hospital on the fourteenth day.

J. N. ANÉ, M.D.

Intravenous Pyelography. Carlos Heuser. Semana Méd., June 19, 1930, XXXVII, 1605-1608.

The author introduces in this article a device which he used for injections for intravenous pyelography. By means of this device, he draws some blood into a bottle and then the fluid to be injected is mixed with it and injected into the patient. The purpose of this is to prevent the formation of scars which occur as a result of extravasation of uroselectan and pyelognost. By avoiding such accidents, the only discomforts that patients may suffer are headache, pain in the shoulder, burning in the throat, and other minor sensations. He presents a case of a patient complaining of pain in the right kidney region, hematuria, and incontinence of urine. Intravenous pyelography was performed and only the left kidney and ureter were found outlined. By serial radiographs, it was found that the left kidney drained well, while the right one did not drain at all.

N. G. GONZALEZ, M.D.

GYNECOLOGY AND OBSTETRICS

Casuistics of Cured Sarcoma of the Uterus. A. Herzog. Strahlentherapie, Sept. 12, 1931, XLII, 198-200.

A woman 51 years old was examined in February, 1926. She had had two preg-

nancies and two miscarriages; the last pregnancy had been ten years previous to the examination. Menstruation was regular until she was 48 years old. From then on the periods were irregular and decreased. She was curetted in January, 1925; the histologic diagnosis was cystic endometritis. The bleeding stopped after that. Beginning in January, 1926, the patient had bleed continuously. She complained of hot flashes and pain in the lumbar region. The uterus seemed slightly enlarged, but, because of an enormous amount of fat in the abdominal walls, could not be definitely outlined. She was curetted and the histologic diagnosis of a polymorphocellular sarcoma made. She refused operation and received X-ray therapy in February and May, 1926, and in March, 1927. At that time the uterus was as large as two fists and the left parametrium was definitely involved.

Patient did not return until January, 1928, when she started bleeding again. She desired operation, which was refused because of the inoperable condition. The uterus was larger than on last examination and both parametria were now involved. X-ray therapy was given in January, 1928. In March, 1928, the uterus as well as the adnexa appeared normal. In October, 1928, she received additional X-ray therapy. However, the patient started to bleed again and the uterus began to enlarge. Under spinal anesthesia, the radical removal was carried out in November, 1928. Histologic examination verified the diagnosis made in 1926. The patient recovered well from the operation and four weeks later resumed her occupation as midwife. She was last seen in July, 1931, still well and without recurrence.

ERNST A. POHLE, M.D., Ph.D.

Studies on the Mineral Metabolism during Pregnancy and Lactation, and its Bearing on the Disposition to Rickets and Dental Caries. Kirsten U. Toverud and Guttorm Toverud. Acto Pediatrica, 1931, XII, Supp. II, 1-116.

In order to study the predisposing factors to rickets and dental caries, 69 salt metabolism experiments were performed on 30 expectant mothers. The total calcium, phosphorus, and magnesium intake was determined for periods of four days during the last three months of pregnancy. The effects of diet and cod liver oil on the inorganic elements in the blood as well as in the breast milk were studied.

Dog experiments were also carried out in which the maternal metabolism as well as that of the young was determined.

The authors conclude that a negative calcium and phosphorus balance in women is often demonstrated during the latter part of pregnancy, and also, less frequently, during lactation. The cause of this negative balance is chiefly deficient mineral content in the everyday diet. Vitamin D deficiency may also pay a rôle. The mineral and vitamin deficiencies in the diet during pregnancy and lactation predisposed offspring to rickets and dental caries. The prevention of these diseases ought to be started in fetal life.

An extensive bibliography is appended. The article is published in English.

E. C. VOGT, M.D.

X-ray Pelvimetry. Dhirendra Nath Banerjee and Gonesh Chandra Mukherjee. Antiseptic, July, 1931, XXVIII, 518-522.

Until recently, radiology played a very small part in diagnostic gynecology, the diagnostic use of the X-ray being limited in obstetrics to the determination of the presence or absence of the fetal skeleton. A few roentgenologists, however, as early as 1900, attempted to estimate the diameters of the pelvis. The various technics which have been employed for this purpose are reviewed and discussed.

The authors' method consists of a combination of the various procedures which have been suggested. The method of Thoms is employed by placing the symphysis pubis and the spine of the fourth lumbar vertebra in the same plane, as measured by the pelvimeter from the surface of the Potter-Bucky diaphragm. The tube is then centered on the intersection of the line joining the anterior superior iliac spines and midline of the body. To

eliminate the necessity of mathematical corrections, because of magnification, a flat brass rod, perforated at intervals of one centimeter, with smaller holes at five millimeters, is employed. This is placed over the thighs at the level of the symphysis in the anteroposterior position and along the spine at the level of the spinous processes of the lumbar vertebræ in the lateral position. In the lateral roentgenogram the promontory of the sacrum is distinctly seen, but the symphysis pubis is often difficult to localize. The authors claim fairly accurate measurements of the pelvis, employing this method.

J. N. Ané, M.D.

Radiation in Pelvic Disease. John F. Herrick. Jour. Iowa St. Med. Soc., February, 1931, XXI, 63-66.

The author concludes a general discussion with this summary: The first requisite is a correct diagnosis; radiation treatment must be carefully controlled and measured by one well qualified. Cases must be carefully selected. Usually radiation is contra-indicated in acute inflammatory disease of the pelvis. Ovarian tumors are not usually suitable for radiation, except in malignant disease, when radiation before and after removal is indicated. Radiation is the treatment of choice in uncomplicated fibroids in women between 38 and 50 years of age. Cancer of the cervix is best treated by radiation, both in cure and prevention. Cancer of the body will yield to radium as certainly as to surgery.

W. W. Watkins, M.D.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Concerning the Universal Thoracic Pulsation. Manuel del Sel and Alberto C. Taquini. Prensa Méd. Argentina, July 30, 1931, XVIII, 255-259.

The author presents a case of posterior aneurysm of the transverse and descending arch of the aorta. The clinical diagnosis was based mainly on the thoracic pulsation, which the author attributes to an advanced aneurysm with destruction of the thoracic wall, causing a movement of expansion. The diagnosis was confirmed with fluoroscopy and radiograms. He concludes that such a posterior aneurysm can be diagnosed clinically through this pulsation, instead of relying entirely on X-rays, as has been the custom.

N. G. Gonzalez, M.D.

Clinical and Radiologic Contributions to the Study of the Azygos Vein. Lorenzo Crosetti. Minerva Med., Apr. 21, 1931, XXII, 606-614.

In reviewing the embryologic theories pertaining to the origin of the azygos vein and the literature existing on the subject, the author points out that both statistics and interpretation of radiographs are somewhat contradictory. He describes and criticizes in detail the various technics used and enumerates those which are most likely to yield satisfactory results. This article includes five complete reports suitably illustrated which, incidentally, were the only ones occurring in 514 observations made at the author's clinic for the study of tuberculosis. Teleradiography was used, with exposures of one-tenth of one second.

The author believes that the difficulty encountered in the interpretation of a film is due either to the lightness of the opaque band of the meso-azygos or to its unusual location, and that it is very easy to mistake the image of the vein for shadows of old sclerotic lesions or calcified nuclei. The anomaly may cause an hypophonia of different intensities in the corresponding apical field. This sign should be of further aid to the semeiotic control, but it must be confirmed by appropriate radiologic examination.

L. Marinelli.

HODGKIN'S DISEASE (THERAPY)

Four Cases of Hodgkin's Disease Treated with Radium. H. E. Guerriero. New Or-

leans Med. and Surg. Jour., April, 1931, LXXXIII, 698-705.

In the cases reported, only the cervical glands were involved, the swollen glands being treated with radium in conjunction with which Fowler's solution was given. The masses uniformly decreased in size and pain disappeared. Such lesions are very difficult to differentiate from tuberculous adenitis, lymphosarcoma, and leukemia in its aleukemic stages.

W. W. WATKINS, M.D.

The Disappearance of Tuberculin Energy in Patients Afflicted by Malignant Lymphogranuloma who have Undergone X-ray Treatment. Cesare Rotta. Minerva Med., April 21, 1931, XXII, 601-606.

The author presents the complete clinical reports of five patients suffering from Hodgkin's disease, whose reaction to 1 per cent solution of Meister-Lucius tuberculin was negative before X-ray treatment and positive afterwards. He also mentions two similar cases which occurred to Professor Micheli. The tests were performed immediately before the cycle of treatments, and a month after the end of it. The doses of radiation given were very large in all cases and varied from a minimum of 2,000 r to a maximum of 6,000 r.

The author advances the hypothesis that roentgen treatment has brought the patients to the relatively normal state of positive reaction found in most individuals.

L. MARINELLI.

THE KIDNEY

Acquired Renal Dystopia or Movable Kidney. Frank Kidd. Jour. Urology, September, 1931, XXVI, 327-378.

The types of renal dystopia are reviewed and a fresh hypothesis is formulated which attributes the most important pathologic type to the persistence from neolithic times of a racial stock of Egyptian origin and descent. The importance of the intra-abdominal pressure is minimized, and the significance of the suspensory ligaments of the kidneys are emphasized. The pathology of movable kidney is placed on a fresh plane, being brought into line with the pathology of sprains and deformities. Pyelography is advocated as the only real guide to treatment, and as the indicator of the reasons for success or failure of operations. An operation for renal dystopia is described, and the points essential for success in operating outlined.

Brandsford Lewis' discussion of the author's paper dwelt in particular on the evidence of stasis in the pelvis and the emptying time of this organ. He also stressed the differential diagnosis.

Clyde Leroy Deming claimed that it is within the realm of every trained urologist to determine conclusively by cystoscopic and roentgenologic examinations, whether or not the nephroptotic kidney is the organ which is responsible for the clinical manifestations. The severity of the component manifestations, the functional disability of the kidney and its influence upon the adjacent organs determine the indications for surgical treatment.

Under indications, the following factors are to be considered:

(1) Pain; (2) pelvic and ureteral stasis; (3) chronic pyogenic infections of the kidney; (4) ureteral kinks; (5) rotations and torsions; (6) traction on adjacent organs; (7) general visceroptosis; (8) aberrant vessels; (9) calculus; (10) neurasthenia, and (11) failure of palliative treatment.

The contra-indications for surgical treatment were stated as follows:

(1) Movable kidney which does not give pain or shows no infection and has normal function and normal emptying time; (2) voluminous hydronephrosis; (3) enlarged liver and spleen; (4) stenosis of uretero-pelvic outlet; (5) large calculus with pyonephrosis; (6) tuberculous kidneys, and (7) non-surgical risks.

Deming described his operation for nephroptosis and his results.

William F. Braasch said that the indications for operation are logical and sound. If they are followed, many operations for nephroptosis which are now being done, will be avoided. On the other hand, that there are indications for operation in a small number of carefully

selected cases is proved by the post-operative results which the author has secured and has demonstrated by means of urography.

Oswald S. Lowsley stated that the endocrine relationship to nephroptosis should be considered. Thorough mobilization of the kidney and ureter is essential for successful nephropexy. He stressed the importance of urography as a factor in the diagnosis. Palliative measures for one year are advocated. Every ptosed kidney should not be operated; general visceroptosis should be borne in mind. It is poor judgment to fix a badly damaged kidney which should be removed. It is equally inadvisable to operate on a ptosed kidney which is draining properly and is symptomless.

Thomas D. Moore stressed the importance of serial pyelographic films during expiration and inspiration, in order to determine the degree of renal excursion, kinks, fixation, and other important data.

The author closed his paper by stating that one must pick his cases in order to get the wonderful results claimed for nephropexy. Palliative treatment should be tried first by all means.

At operation the kidney is anchored, not fixed. Very soon the adhesions made at operation once more begin to stretch and the kidney again takes on in a few weeks a definite and swinging action. This action is never as great as before operation and thereby the kidney retains its high position.

DAVIS H. PARDOLL, M.D.

Influence of High Protein Diets on the Kidney. R. Klein and O. Bergeim. Proc. Soc. Exper. Biol. and Med., 1931, XXVIII, 590, 591.

Various types of protein in a standard diet were fed to 36 rats in groups of 9. One rat in each group was killed by $CHCl_3$ after 19, 35, 70, and 135 days; the kidneys were weighed and examined histologically. Rats fed a diet of 75 per cent protein showed renal hypertrophy in 40 per cent of the cases. Rats receiving meat powder or keratin along with 60 per cent casein in their diets for from 35 to 135 days showed swelling of the tubular cells, degeneration of the nuclei, and many tubular casts. The changes were most marked in the group receiving meat powder. The indigestible protein of horn with its presumably accompanying intestinal putrefaction had no marked effect upon the kidneys. Predigestion of the casein, which should facilitate the absorption of amino acids, did not seem to influence the result.

CHEMICAL ABSTRACTS.

MEDICAL PRACTICE

The Problems of Radiology in India. P. B. Mukerji. Antiseptic, July, 1931, XXVIII, 464-472.

With the firm conviction that the practice of radiology should be recognized as a specialty in the practice of medicine and that the radiologist should be considered as a consultant and a specialist, the author discusses and suggests solutions of the many problems confronting radiologists in general and those of India in particular. The proper education of the medical profession and the public in this regard is believed of utmost importance.

The qualifications of a radiologist as summarized by Martin are as follows: (1) Possession of a degree in medicine from a recognized university; (2) a command of the best technical procedures used in diagnostic radiology; (3) a thorough knowledge and experience in roentgenographic interpretation; (4) a knowledge of modern medicine sufficiently broad to make him a true consultant; (5) a broad knowledge of radiotherapy with reasonable experience in this field; (6) the ability and willingness to teach; (7) some familiarity with research problems. The term "radiologist" should not be confused with "radiographer." A radiographer is a lay-assistant, a non-medical man, or a technician who knows how to handle X-ray equipment in order to obtain roentgenograms, or to carry on X-ray therapy when the dosage has been prescribed by a radiologist or a physician trained in the science of radiology. While

the technical work can be performed efficiently by a radiographer, the interpretation of roentgenograms and fluoroscopy in terms of pathology should be done only by a radiologist, who has a knowledge of pathology, clinical medicine, and surgery.

The author believes that if the X-ray department of a hospital is to be of real value, a radiologist should be in charge. The practice in many hospitals of adding the radiologic work to the duties of the already overworked medical officer does not lead to the best that can be obtained in the practice of radiology. It is absurd to expect general practitioners, such as medical officers in charge of hospitals, to keep abreast of all advancements and developments in a specialty of medicine, which is the most technical of medical specialties. The proper solution, in the author's opinion, is the placing of a radiologist in charge of the radiologic department.

The importance of roentgenology has often been improperly interpreted by the public and, what is much worse, also by some doctors who believe or make their patients believe that with the aid of roentgenology all occult diseases may be diagnosed. On the other hand many clinicians regard radiology as a joke not worthy of their consideration, or request a roentgenogram made but desire to interpret it themselves, thus treating the radiologist as a photographer. Clinicians should require from radiologists what they expect from other qualified specialists, and the radiologist should be given the essential clinical data and if possible an indication of the clinician's opinion.

In almost all of the universities in India, with medical faculties, attendance at a course of from six to fifteen lectures in radiology is demanded of the students. The author believes that at least twenty lectures are necessary to impart to the students a satisfactory foundation in radiology. He further deplores the fact that there are professors in almost every branch of medicine in Indian universities except in radiology.

J. N. Ané, M.D.

The Present Position of Radiology as Regards Diagnosis and Therapy. M. D. Joshi. Antiseptic, July, 1931, XXVIII, 449-463.

Like all new discoveries and inventions, radiology has passed through the stages of ridicule, opposition, and suspicion, but it is now recognized as one of the most essential and important additions to our armamentarium of diagnosing and treating various pathologic conditions. Radiology does not deprive the practitioner of his acumen in diagnosis, for if properly utilized and interpreted, it serves rather to improve his methods of clinical diagnosis by enabling him to correlate more accurately the clinical data with the pathologic changes. The author considers it the duty of the radiologist to carefully investigate the clinical data before making a radiologic diagnosis.

The author discusses the preparation of the patient and the value of radiology in the diagnosis of diseases of the bones, joints, chest, alimentary and urinary systems, in gynecology, and in obstetrics. He further classifies and discusses therapeutic radiology.

Inflammatory affections of bones are characterized by the fact that there is no sharp demarcation line between the affected and normal portions of bone, and by the presence of periosteal reaction. Radiologic examination is particularly useful in detecting and locating sequestra. Tumors of bone are characterized by the presence of a sharp line of demarcation between the normal and involved bone and by the absence of periosteal reaction.

X-ray examination of the chest will demonstrate the following: (1) Affections of the ribs or thoracic vertebræ; (2) pathologic conditions of the pleura and pleural cavity; (3) consolidation, fibrosis, or cavity formation in the lungs; (4) conditions of the bronchi and hilum glands; (5) size and shape of the heart and aorta, and (6) enlargement of the thymus and mediastinal glands or mediastinal tumor.

In the study of the alimentary tract he recommends the use of barium sulphate in buttermilk as the opaque meal. Various pathologic conditions of the esophagus, stomach, duodenum, cecum, appendix, and colon may thus be studied and differentiated. The gall bladder is best examined after the

oral administration of sodium tetraiodophenolphthalein.

X-ray and radium are employed in the therapy of many diseases which are intractable either to medical or surgical treatment. Generally, radium should be used for small localized lesions, whereas it is more convenient to give X-ray exposures on extensive lesions, such as secondary carcinoma. Besides their use for malignancy radium and X-ray therapy are useful in many other conditions, such as leukemias, tuberculous glands, fibroids, keloids, lupus, eczema, psoriasis, and rodent ulcer.

The author concludes that proper co-operation between the clinician, pathologist, and radiologist will make possible a much more rapid advance in radiology.

J. N. Ané, M.D.

MYOSITIS OSSIFICANS

Contribution to the Casuistry of Post-traumatic Muscular Ossifications. I. Bigliardi. L'Ateneo Parmense, May-June, 1931, III, 160-168.

The study of post-traumatic muscular ossifications, begun by Billroth, in 1872, may now be said to be complete, especially since, with the advent of radiology, we have been enabled to study this rather unusual lesion with detailed and prolonged observations to determine in part its origin, and to follow its clinical evolution.

Of particular interest is the radiographic study of muscular ossification. In the first period, soon after the trauma, there is noted the presence of a circumscribed and rather faint shadow somewhat more opaque than that of the muscular tissue and of much smaller volume than the palpable mass. This shadow, in successive examinations made at increasing periods of time after the trauma, takes on constantly greater opacity, with the formation of darker, intermingled with lighter, zones, since the neoformation is not the result of a single osseous mass, but often of various fragments made up of connective tissue, muscular fibre, and adipose tissue.

This shadow finally assumes the characteristic skeletal opacity; then slowly retrogrades until there remains on the plate only a small, thin focus of ossification which soon entirely disappears.

The author studied four cases of post-traumatic muscular ossification in the Radiologic Institute of the Ospedale Maggiore, of Parma. The first two were cases of ossification of the brachial muscle. The first is of particular interest, in view of the precocity of the osseous neoformation observed within a period of ten days after the trauma. The third case showed ossification of the great lateral muscle, while the fourth report described a case of Pellegrini-Stieda's disease.

It is certain that at the present stage of science nothing is definitely known regarding the genesis of this species of ossification. The various theories expounded have been in part superseded, while others fail to withstand scientific test. Undoubtedly, that of Orlow satisfies better than any other the clinical tests and experimental results.

W. W. Whitelock, Ph.D.

NERVOUS SYSTEM (GENERAL)

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve. Part I.—The General Action of X-rays, Especially the Relation with Blood Pressure. S. Suzuki. Japanese Jour. Obstet. and Gynecol., June, 1931, XIV, 207-213.

Experimenting with healthy female rabbits, the author studied the effects of X-irradiation upon the vegetative nerves as demonstrated by changes in the blood pressure. The factors used were as follows: Effective pressure, 150 K.V.; 2 ma.; focal skin distance, 23 cm.; no filtration; time, 35-40 minutes. An abdominal field 8 $\times$ 6 cm. was selected and the remainder of the animal protected by 3 mm. of lead rubber.

The highest blood pressure of the healthy control animals was found to vary from 86 to

108 mm. Hg, with a pulse pressure of from 5 to 6 mm. Hg. One hour after irradiation the blood pressures, as a whole, showed a very slight fall, but the pulse pressure increased generally and in some cases rose to 22 mm. Hg. From two to three hours following irradiation there occurred a marked fall in blood pressure in all of the animals. The blood and pulse pressures returned to normal in from seven to ten days.

Comparisons of the effects upon the blood pressure of adrenalin in control and irradiated animals were also made. One hour after irradiation the rise in blood pressure following adrenalin was only slightly restrained. This antagonistic action to adrenalin was greatest from three to five hours following irradiation and persisted for from seven to ten days, at which time the normal conditions and reactions returned. It was possible also to abolish this restraining effect to the action of adrenalin at any time after irradiation by the administration of atropine.

Similar experiments were performed on healthy non-irradiated animals, using pilocarpine as a stimulant to the parasympathetic nerves, results similar to those noted in the irradiated series being observed in every case. The author, therefore, concludes that X-irradiation produces a hypertonic condition of the parasympathetic nervous system.

J. N. Ané, M.D.

Experimental Investigation of the Effect of Roentgen Rays upon the Vegetative Nerve. Part II.—Pharmacologic Investigation of the Effect of Irradiation on the Inferior Mesenteric Ganglion upon the Uterine Motion. S. Suzuki. Japanese Jour. Obstet. and Gynecol., June, 1931, XIV, 214-217.

The author irradiated the inferior mesenteric ganglions of rabbits and studied the effects upon the uterus. Following laparotomy a lead cylinder was placed over the inferior mesenteric ganglion, and the remaining tissue, including the uterus and ovaries, were protected by a lead-rubber plate. The factors used were as follows: 150 K.V.; 2 ma.; distance, 23 cm.; no filtration; time, 35 minutes; the shortest wave length, 0.78–0.80 Å.E. The drugs employed were adrenalin, pilocarpine, pituglandol, secacornin, and barium, which were injected into the auricular vein.

The day following irradiation the uterine tissue was found only slightly sensitive to secacornin and barium, but markedly sensitive to pilocarpine. From nine to eleven days following irradiation, marked sensitivity was noted to all the drugs employed. A decrease in sensitivity occurred from 20 to 21 days after irradiation, but from 28 to 30 days following X-radiation uterine excitability again increased, so that sensitivity was greater at this stage than at any other time. Microscopic examination of the irradiated inferior mesenteric ganglion revealed retrogressive changes. The uterine tissue showed evidences of congestion and development of glands of the muscular layer. Thus, the effects noted upon the uterus were secondary to those observed upon the ganglion. The author believes that the increased sensitivity to pilocarpine on the day following irradiation was due to the hypertonic condition of the parasympathetics, induced by the irradiation.

J. N. Ané, M.D.

The Radiosensitivity of Nervous Tissue. A. Zimmern and J. A. Chavany. Strahlentherapie, 1931, XLI, 482-495.

The entire literature dealing with the biologic effect of radiation (roentgen rays and radium) on nervous tissue is critically discussed by the authors. It is regrettable that no bibliography of the quoted articles has been appended.

Ernst A. Pohle, M.D., Ph.D.

RADIATION

Complement Properties of the Blood Serum or Alexin Reaction Following Roentgen Treatment. J. Heeren. Strahlentherapie, Sept. 12, 1931, XLII, 189-197.

The serum of fifty patients was examined with the hemolysis reaction modified by

Huntemüller (see *Zentralblatt f. Bakt.*, CX, 150). The results are compiled in a table giving the diagnosis and reaction and also the dose applied in r units. In the majority of patients, there were slight changes in the complement properties of the serum. No uniform change could, however, be noticed. There was no relation between the complement reaction and certain groups of disease.

ERNST A. POHLE, M.D., Ph.D.

Concerning the Question of the Distribution of X-ray Intensity in the Body in Deep Therapy. II.—Fundamental Considerations. M. Dorneich. Strahlentherapie, Sept. 12, 1931, XLII, 56-86.

The author has continued his studies on the determination of isodoses; this paper deals with the errors involved in the photographic method of measuring X-ray intensities in a water phantom (See also *Strahlentherapie*, 1930, XXXVIII, 591). While it does not lend itself well to abstracting, the paper is recommended for study in the original to all those interested in the effect of roentgen rays on photographic emulsion for quantitative determinations.

ERNST A. POHLE, M.D., Ph.D.

The Biological Effect of High Voltage X-rays. Charles Packard and C. C. Lauritsen. Science, March 20, 1931, LXXIII, 321, 322.

The well known studies of Packard and Wood, on the killing effect of roentgen rays of various wave lengths upon the ovum of *Drosophila*, have been extended to an average wave length of 0.04 Å.U., produced by Lauritsen's 550 K.V. tube in the California Institute of Technology. The previous results, namely, that the same number of r-units applied produced the same biologic effect independent of the wave lengths was again confirmed for these hard rays produced with 550 kilovolts. The same results were obtained with a mouse tumor (Sarcoma 180). The lethal dose was tested by inoculation of radiated small pieces into healthy animals. A number of tests with the particles radiated at 550 K.V. showed the lethal dose to be about 2,750 r. This agrees well with the dose found by Wood by the same tests at softer rays (0.20 and 0.70 Ångström unit).

OTTO GLASSER, Ph.D.

Several Facts Concerning Cancer Tissue as Brought Out by Radiotherapy. Cl. Regaud. Arch. Rad. Institute, University of Paris and Curie Foundation, 1931, II, Part 3, 371-383.

In a typical epidermoid epithelioma the cancerous tissue evolves between a zone of multiplication (ordinarily peripheral, and where the germinative cells are situated) and a zone of desquamation (ordinarily central and occupied by the squames which terminate the sterile cellular lines). In other cancers, the germinative cells and the cells of the sterile lateral lines are mixed. In still others lateral lines are not found; all the cells appear fertile.

The histologic study of the transformation of epidermoid cancer tissue treated by radiation demonstrates the following: The disappearance of the germinative cells; the continuation of evolution of the cells of the lateral lines towards keratinization; the increase, then the resorption of the masses of squames, and temporary modifications in the population of the connective tissue.

A series of analogous phenomena observed in the thymus treated by rays has shown that the corpuscles of Hassall are formations which are not permanent but variable.

Everything leads to the conclusion that, in a non-irradiated epidermoid cancer, the clumps of squames (horny pearls) are formations which are not permanent but variable—whose volume at any moment represents a difference between their increase and their resorption.

The internal life of cancerous tissues is not only a question of phenomena of increase, but also of phenomena of resorption; the increase in volume of the tumor is a measure of the

difference of intensity of these two phenomena.

Holocrine secretion, of which cancerous tissues are the site, could furnish a plausible hypothesis for the explanation of the eventual acquisition of special properties by the serum of those afflicted with cancer.

B. J. De Laureal, M.D.

RADIATION SICKNESS

The Symptomatic Treatment of X-ray Sickness Following Roentgen Deep Therapy. E. B. Hüffer. Strahlentherapie, Sept. 12, 1931, XLII, 181-188.

The author has treated a series of patients who received X-ray deep therapy with preparations usually prescribed in sea sickness. One is called "vasano" and the other "nautisan." The first is a mixture of hyoscyamin and scopolamin 3:1, and the second contains chiefly trichlorisobutylakcohols with an addition of caffeine. He obtained good results in a high percentage of cases and recommends these drugs, therefore, in the prevention or treatment of X-ray sickness. A combination of both did not improve the results.

Ernst A. Pohle, M.D., Ph.D.

Roentgenotherapy and Cholesterol Content of the Blood Serum. Colsil and X-ray Sickness. Elisabeth Willms. Strahlentherapie, Sept. 12, 1931, XLII, 171-180.

This study was undertaken to determine the cholesterol changes in the blood serum following irradiation, as well as the therapeutic value of colsil (cholesterol pills) in the prevention or treatment of X-ray sickness.

It appeared that patients with malignant tumors usually had an increased cholesterol content in the blood serum, varying between 0.276 mg. per cent and 0.484 mg. per cent. Twelve out of nineteen cases showed the increase in either normal or subnormal values. Cholesterol determinations were also made before and after X-ray therapy. No correlation could be established between the X-ray sickness and cholesterol content in the blood serum. If normal persons received colsil, the cholesterol content in the blood serum was higher and remained so up to twenty-four hours following the administration. Of eight treated cases, four had X-ray sickness in spite of colsil; one patient who had the most violent attack of X-ray sickness had a higher cholesterol content in the blood serum than before irradiation.

It is concluded, therefore, that the cholesterol changes in the blood serum are not alone responsible for X-ray sickness. Colsil must not be considered of curative value in all cases but may help a certain group of patients.

Ernst A. Pohle, M.D., Ph.D.

RADIUM

Physics of Radium and Radium Therapy. M. J. S. Pillai. Antiseptic, July, 1931, XXVIII, 491-498.

Radium therapy originated in 1901, as a result of the famous "Becquerel burn." Radium is a metal of the alkaline earths, similar to calcium, barium, and strontium. Its atomic weight is 226.45 and its melting point is 700 degrees centigrade. Alpha, beta, and gamma radiations are emitted simultaneously, their relative proportions being approximately 10,000:100:1.

The alpha-rays of radium are atoms with a positive electric charge and are deflected by strong electric or magnetic fields. Alpha-rays are absorbed by about three inches of air, or thin sheets of paper, metal, or rubber. Beta-rays are similar to the cathode rays, but are more penetrating. The hardest of these rays do not penetrate more than three-eighths of human tissue, 4 mm. of aluminum, or 1 mm. of lead. Gamma-rays are similar to X-rays, although the hardest gamma-rays are more penetrating.

The methods of application of radium are as follows: Surface application, teleradiotherapy, and interstitial. The author advises the careful preparation of the patient before employing radium therapy and suggests the

following precautions: (1) All septic foci should be eliminated; (2) a red blood count of below 1,000,000 per c.c. is a contra-indication to radium application; (3) massive doses of radium should not be employed in the treatment of advanced lesions of the liver, kidneys, or heart; (4) in cases of lesions of the pelvis, situated deeply, a combined treatment of radium and deep X-ray therapy is more valuable than treatment with either alone; (5) the treatment of menorrhagia should be administered soon after the menstrual period ends, in order to avoid the usual reactionary excess which follows treatment; (6) in general, a diagnosis describing the exact pathologic condition of the involved tissue will prove valuable in the proper application of radium therapy.

It has been established that some tissues are more easily controlled and destroyed than others. The response to irradiation is further modified by the nature of the resistance of the patient and the size, site, and condition of the tumor. In general, radiosensitivity is found to be greater in cells with greater reproductive capacity.

Very much brilliant work has already been accomplished in the study of radium therapy and its application. The author believes that the close co-operation of physicists, clinicians, radiologists, and pathologists will accomplish very much in adding valuable information to our knowledge of this form of therapy. He cautions against the dangers resulting from the use of radium by unskilled workers.

J. N. Ané, M.D.

Activation of Ergosterol with Radium Emanation. Richard B. Moore and Thomas DeVries. Jour. Am. Chem. Soc., 1931, LIII, 2676-2681.

Ergosterol can be activated with Rn to a degree of potency perhaps 0.01 of that of a good grade of ultra-violet-irradiated ergosterol. Stirring the sample while it is under the influence of Rn increases the speed of activation but does not increase the potency appreciably. There is no appreciable loss in potency if the activation is carried on to even as much as a 20-fold excess. There are some decomposition products formed in all cases.

Chemical Abstracts.

RICKETS (DIAGNOSIS)

The Distribution and Frequency of Rickets in One of the Fishery Districts of Finmark, and Relation of Diet to the Disorder. Johan Kloster. Acta Pediatrica, 1931, XII, Supp. III, 1-82.

The data in this article were collected from the Vadsoe Medical District of arctic Norway.

The author records very careful clinical studies, as well as interesting general observations, to show that, contrary to the common belief, rickets is common among the children living in the arctic regions.

He found traces of rickets in 43 per cent of the children under seven years of age. In 7 per cent the rickets was especially distinctive. He found no cases of rachitis tarda. Congenital syphilis and scurvy are very rare in this district.

He goes, with considerable detail, into the factors which probably have a bearing on the prevalence of the disease, as diet, sunlight, climate, and conditions of habitation.

E. C. Vogt, M.D.

The Absorption Spectra of the Blood and Their Relation to Rickets. R. C. Gibbs, J. R. Johnson, and C. V. Shapiro. Strahlentherapie, June 13, 1931, XLI, 161-168.

The Absorption Spectra of the Blood and Their Relation to Rickets. R. Suhrmann and W. Kollath. Strahlentherapie, June 13, 1931, XLI, 169, 170.

The authors of the first paper published the results of their studies of the absorption spectra in the blood of healthy chickens and

rats as compared with animals which have rickets, as observed by themselves and by Suhrmann. Their results do not agree with those reported by the latter. In a brief communication, Suhrmann and Kollath offer several explanations for the discrepancy.

ERNST A. POHLE, M.D., Ph.D.

ROENTGEN DIAGNOSIS AND THERAPY

The Rôle of Radiography in the Diagnosis of Diseases of the Lung. S. K. Basu. Antiseptic, July, 1931, XXVIII, 510, 511.

The author considers X-ray examination of the lungs superior to physical examination in the following conditions: (1) Early tubercle complicated by bronchitis; (2) deep-seated and closed early lesions; (3) hilum tuberculosis; (4) recrudescence of old lesions; (5) necessity of application of artificial pneumothorax treatment successfully.

It is emphasized, however, that in all cases a physical examination should be made and correlated with the roentgenographic findings.

J. N. ANÉ, M.D.

Radiology in Diagnosis. M. Mukherji. Antiseptic, July, 1931, XXVIII, 473-490.

The author discusses the indications and limitations of radiology in the diagnosis of disease. In order that radiology may be a reliable diagnostic aid, it is essential to have a standard of minimum requirements for the roentgenologist and roentgenography. The roentgenogram should be so made that the utmost of detail and contrast is obtained. Having procured such a roentgenogram it is necessary that it be interpreted in terms of pathology by one who has been properly trained in this work.

The radiologist should possess a working knowledge of applied anatomy, pathology, and physiology, together with a general knowledge of medicine and surgery, besides his specialized knowledge of the science of radiology. He should have the co-operation of the clinician and pathologist so that he may have the opportunity for studying and following up the cases after they have passed through his hands. Confirmation of diagnosis creates self-confidence and increases the diagnostic ability of the radiologist. In like manner, attendance in the operating room and postmortem room will prove valuable aids in the study of disease. The radiologist should not be considered an intruder by the clinician, but these two practitioners of medicine should meet and discuss the data obtained.

Radiology has been extremely valuable in giving us a truer knowledge about "practical normals" as met with in the every-day practice of medicine, in contradistinction to the "theoretical normals" of the dissecting room. The author suggests the inclusion of such a course of X-ray demonstrations of the normal human anatomy from the living in the curriculum for the students in the various medical schools and colleges. Our idea of "habitus" resulted from the X-ray examination of large numbers of healthy persons of different body builds. Thus the normal variations in the size, shape, and position of the abdominal and thoracic viscera were noted and consequently fewer cases of ptosis of the colon and stomach have been diagnosed. In this manner, radiologists have recognized the normal variations in "practical normal" chests.

The author discusses the value of radiology in pathologic conditions of the various organs and systems. Next to laparotomy, radiologic examination affords the most accurate information as to the presence or absence of diseases of the stomach or intestines. He especially emphasizes the value of fluoroscopy in gastro-intestinal work, for indirect and direct signs can best be studied on the screen. In gastro-intestinal work the value of radiography lies not in demonstrating the alterations that cannot be seen on the screen but in corroborating the fluoroscopic observations and giving time to the roentgenologist to come to a well-reasoned conclusion.

J. N. ANÉ, M.D.

X-ray Therapy: Its Principles and Practice, with Special Reference to Deep Ther-

apy. K. P. Mody. Antiseptic, July, 1931, XXVIII, 512-517.

While X-rays are somewhat similar to light waves, the wave lengths of the roentgen rays are so much shorter that their effects on human tissues are much more profound and powerful. X-rays are composed of rays of many wave lengths, the long waves having their maximum effect on the skin, and the short ones penetrating deeply. In this manner, the wave lengths are selected according to the nature and depth of the lesion.

A malignant tumor—being a purposeless, irrational, irregular reproduction of cells, serving no useful purpose, replacing, invading, and destroying healthy tissue—naturally does become a rather complicated problem. The cells are in various stages of division and reproduction and vary in their response to the X-rays, for some are radiosensitive and others are radioresistant. The X-ray dosage should be such that all of the pathologic cells are destroyed but the minimum danger done to the normal surrounding tissue.

Many methods are used to determine the X-ray dosage applied. The pastille method of Sabouraud while excellent for superficial therapy is unreliable in deep therapy. The skin tolerance dose method of the Germans is believed by the author to be of some value. However, individual variations in sensitivity to the rays occur which render the accurate estimation of the erythema dose difficult. In spite of inaccuracies, the author is of the opinion that the erythema unit dose method remains as the most practical method of dosage yet evolved. The use of the "sphere gap" and the iontoquantimeter of the French is also mentioned. The design of the latter type of apparatus is based on the fact that air, ordinarily a non-conductor, becomes a good conductor when the X-rays are directed on it. The determination of the "depth dose," which depends on the voltage, filter, and skin-target distance, is of great importance.

There is some difference in opinion regarding the period of time during which the full dose should be given. In some laboratories the total dose is given at a single sitting. The disadvantage of this technic is that it is very exhausting to the patient and in some cases results in considerable disturbance to the general health. The French, on the other hand, divide the total dose into several sittings. The neoplastic cells are in different stages of division and reproduction and by applying divided doses it is hoped that all the cells may be destroyed during the radiosensitive phase.

J. N. Ané, M.D.

Outline of Roentgen Diagnosis (first paper). Leo G. Rigler. Journal-Lancet, Feb. 15, 1931, LI, 143-147.

This article is the first of a series on the subject, running in this journal. This paper covers the following points: *(A)* Nature and Value of Roentgen Examination; *(B)* X-ray Films—(1) characteristics of a roentgenogram; (2) factors affecting the production of an X-ray film; (3) common errors and confusing shadows; (4) technical facts of especial importance; *(C)* X-ray shadows in the body—(1) gas, (2) fat, (3) internal organs, (4) muscles, (5) blood-containing organs, heart, blood vessels, (6) calcium, (7) foreign bodies, especially metallic; *(D)* Aids to Examination—(1) general considerations, (2) introduction of air or other gases, (3) barium and bismuth salts, especially barium sulphate, (4) sodium iodide, etc., (5) iodized oil, (6) gall-bladder dye, (7) uroselectan; *(E)* Methods of Roentgen-ray Examination and Their Attributes—(1) films, (2) fluoroscopy; *(F)* Diseases and Organs which should be Examined with the Roentgen Ray as an Aid to Diagnosis—(1) osseous system, (2) the head, (3) respiratory tract, (4) heart and great vessels, and, to a lesser extent, all the arteries, (5) diaphragms, mediastinum, thymus, and thyroid, (6) gastro-intestinal tract, (7) gall bladder, (8) urinary tract, (9) genitalia, (10) pregnancy, (11) miscellaneous conditions; *(G)* Definition of Terms.

W. W. Watkins, M.D.

Outline of Roentgen Diagnosis (second paper). Leo G. Rigler. Journal-Lancet, March 1, 1931, LI, 181-184.

This paper considers the following: Bones

and Joints (normal characteristics as to growth and normal variations); Traumatic Conditions of Bones and Joints—(1) Fractures, (2) Information gained from X-ray examination in cases of bone injury, (3) Characteristics of various fractures, (4) Non-union, (5) Operative findings, (6) Infected fractures, (7) Periosteal tear and traumatic periostitis; dislocations.

W. W. WATKINS, M.D.

Outline of Diagnosis (third paper). Leo G. Rigler. Journal-Lancet, March 15, 1931, LI, 204-208.

This paper covers the following: Infectious Processes of Bones, as acute, chronic, and secondary osteomyelitis, acquired syphilis, tuberculous osteomyelitis, and miscellaneous conditions; Bone Tumors, under the headings of general considerations, benign and malignant tumors (primary and secondary), Hodgkin's disease, and Paget's disease. These are correlated with the classification of the American College of Surgeons.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (fourth paper). Leo G. Rigler. Journal-Lancet, April 1, 1931, LI, 233-235.

This article covers the following: Diseases of Joints, under the subdivisions of "Normal appearance," "Points to be noted in the study of joint lesions," "Classification and terminology," "Findings in joint lesions" (including acute rheumatic fever, acute arthritis, chronic arthritis resulting from the foregoing, chronic arthritis of non-specific etiology, gout, osteochondritis dessicans, osteochondromatosis, Charcot joint, tuberculosis of joints).

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (fifth paper). Leo G. Rigler. Journal-Lancet, May 1, 1931, LI, 294-296.

This article continues the consideration of joint diseases under the heading of Diseases about the Joints in Children, including rickets, scurvy, congenital syphilis, and differential diagnosis. Other conditions included are: achondroplasia, fragilitas ossium, Mongolian idiocy, cretinism and myxedema, osteomalacia, osteoporosis, osteochondritis juvenilis deformans, Osgood-Schlatter's disease, Köhler's disease, Freiberg-Köhler's disease, and Kienböck's disease.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (sixth paper). Leo G. Rigler. Journal-Lancet, May 15, 1931, LI, 320-322.

This paper is devoted to Diseases of the Spine, and covers anomalies and deformities, traumatic conditions, infectious diseases, tumors, and iodized oil injections into the spinal canal.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (seventh paper). Leo G. Rigler. Journal-Lancet, June 15, 1931, LI, 386-389.

This paper includes Normal Anatomy (vascular grooves, sutures, basal structures, convolutional markings), Fractures, Diseases of the Skull, Intra-cranial Conditions (with ventriculography and encephalography), the Sella Turcica, the Mastoids, etc.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (eighth paper). Leo G. Rigler. Journal-Lancet, July 1, 1931, LI, 417-420.

This paper considers the thorax. It takes up the heart and aorta under methods of examination, the normal heart and aorta, technical points, pathologic changes in the heart and pericardium (including mitral regurgitation; mitral stenosis; double mitral; aortic or hypertensive type; combined mitral and aortic valvular disease; tricuspid and pulmonic

lesions; right heart hypertrophy and failure; generalized cardiac enlargement; congenital heart disease; pericardial effusion; adhesive pericarditis), and pathologic changes in the aorta.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (ninth paper). Leo G. Rigler. Journal-Lancet, Aug. 1, 1931, LI, 478, 479.

This paper deals with the following: The mediastinum (including normal appearance, mediastinitis, mediastinal effusions, mediastinal abscess, substernal thyroid, dilated large veins of the neck, thymus gland, dilated esophagus, paravertebral abscess, glandular enlargements, tumors) and the diaphragms.

W. W. WATKINS, M.D.

Outline of Roentgen Diagnosis (tenth paper). Leo G. Rigler. Journal-Lancet, Sept. 1, 1931, LI, 547-550.

This paper continues the study of the diaphragms. The pleura is then taken up under the headings of general considerations, pleural thickening, pleural effusion, pneumothorax, hydropneumothorax, tumors. The next division includes the lungs, trachea, bronchi, under the subheads of value of X-ray examination, technical consideration, and methods, normal appearance.

W. W. WATKINS, M.D.

X-Ray in Diagnosis of Thoracic Pathology. Hermon Harrison Cole. Illinois Med. Jour., September, 1931, LX, 260-262.

What should a clinical diagnostician expect of the radiologist in the thoracic field? What has the radiologist a right to expect in return? If both are to make the diagnosis, then the facts of the history, physical findings, and laboratory findings should be in the hands of both men.

The radiologist, purely on his own, can interpret light and shadow in terms of relative tissue density and note unusual locations. It is unfair to him and often dangerous to his reputation to ask him to do more. To refuse a diagnosis by radiography alone takes more courage than shrewd guessing.

Differences between anthracosis, silicosis, bronchopneumonia, carcinoma, fibroid tuberculosis, and syphilis are not clear enough at times for certain X-ray identification. The radiologist has a right to history, blood examination, sputum, and other pathologic reports and physical findings.

The author insists that the radiologist read the plate in terms of pathologic densities without reference to final diagnosis. This last is the province of both working together, or of the clinician alone.

He believes that all chest plates should be made with a minimum of exposure and at two meters distance. Stereoscopic plates should be the rule. We have not learned to use lateral and oblique views as often or as intelligently as we should.

CHARLES H. DEWITT, M.D.

ROENTGEN RAY (INDUSTRIAL APPLICATION)

Radiographic Inspection of Metals. Herbert R. Isenburger. Mech. Engineering, October, 1931, LIII, 1-8.

Radiographic examination is one of the most reliable methods of non-destructive routine testing of the structure of metals. In this work roentgenograms made by means of a penetrating radiation of X-rays are known as "exographs" as distinguished from "radiographs" made by means of gamma-rays obtained from radium or its emanation.

The author believes that X-rays should be employed on steel castings and forgings having a thickness of three inches and less, and that gamma-rays should be used for examination of heavier material. More detail, better contrast, and a shorter exposure time result from the use of X-rays; therefore this form of radiation should be used whenever possible.

Radiography is of great value in foundry

and welding practice, as in many cases the possible failure of a casting or forging would cause damage far in excess of the cost of the examination. It has been demonstrated that the undesirable internal conditions in castings fall into relatively few classes, all of which are traceable to definite and simple causes, which can be eliminated by proper foundry practice. It likewise has been shown that when defects have been corrected by proper changes in foundry methods, they tend to stay corrected. Among the undesirable conditions in steel castings mentioned by the author are the following: gas, slag and sand pockets or inclusions; shrinkage cavities or cracks; spongy metal; hot tears, and rupture developed during pressure test.

It is suggested in welding practice that all work should be correlated with the X-ray evidence. Sample welds should be made in scrap pieces of the kind of plate to be used in construction and these should be X-rayed. Production should be delayed until the test films are perfect and the correct procedure determined.

J. N. Ané, M.D.

THE SKULL (DIAGNOSIS)

Encephalographic Studies in Cryptogenic Epilepsy. J. Notkin. Archiv. Neurol. and Psychiatry, July, 1931, XXVI, 115-130.

The author's apparent purpose in making this study was to confirm or reject the statements of Fay and others who say that there is a characteristic encephalographic picture in cryptogenic epilepsy. Fay states: "There has been noted a characteristic picture obtained by roentgenograms in those patients showing convulsive state . . . . a definite change can be demonstrated in the fluid pathways by this method."

Notkin performed encephalography on 17 epileptic women between the ages of 18 and 49, of whom 14 were definitely deteriorated mentally. The results of encephalography were classified in three groups:

(1) Those patients presenting normal appearances; (2) Those with pronounced dilatation of the ventricles and of the subarachnoid spaces; (3) Those with appearances that point to some pathological change different from that in Group 2.

In 8 patients (47 per cent), the encephalographic appearances were normal.

In Group 2 there were 4 cases (24 per cent). Air persisted in this group for as long as 216 hours and apparently depended on the degree of dilatation of the ventricles.

The third group, comprised of 5 cases (29 per cent), either showed no evidence of the ventricles, or else they were distorted and asymmetrical both in size and location. In addition, patients with pronounced leptomeningeal adhesions were included in this group. The diagnosis of the adhesions was based on the absence of sulci markings.

Notkin concluded, in part, that the persistence of air within the cranium seems to correlate more with the dilatation of the ventricles and of the subarachnoid spaces than with the amount of air injected, and also that subarachnoid dilatations may rarely be seen in roentgenograms taken before the injection of air.

Cornelius G. Dyke, M.D.

THE SPINE (DIAGNOSIS)

Compression Fracture of the Fourth Lumbar Vertebra of a Calf. Tom Hare. Jour. Path. and Bacteriol., July, 1931, XXXIV, 437, 438.

A case is reported of a fractured vertebra of a young calf, which appears to be comparable with fracture of the human spine. Careful postmortem studies fail to support the notion, originally advanced by Kümmell, that the lesion is the delayed collapse of an injured vertebral body

E. C. Vogt, M.D.

A Study of Back Complaints in 1,000 Patients. Clarence B. Francisco. Med. Bull.

Veterans' Administration, September, 1931, VII, 808-815.

Following his first analysis, four years previously, of 1,000 cases with back complaints, the author has re-examined and treated many of these cases for their back conditions. About 75 per cent of thirty-six cases of tuberculosis of the spine died during this four-year period. It was also observed from the roentgenograms that hypertrophic changes around the vertebral joints and calcification of ligaments tended to increase very slowly, if at all.

The outstanding observation, in the author's opinion, is that the cause of spinal disability is, with a few exceptions, located in the lower spine or its attachments to the pelvis. Of the 1,000 cases, fifteen were vertebral fractures, and in those cases in which the cord escaped injury, the results were not painful or the backs weak. The disability complained of was stiffness of the back and areas of anesthesia irregularly distributed over the legs.

Thirty-five cases of developmental lateral and posterior curvatures and thirty-eight cases of residuals of spinal meningitis were observed. One hundred twenty-eight cases were diagnosed arthritis of the spine. The forty-four acute cases showed no evidence of bone or joint changes on roentgenograms and became free from symptoms by removal of foci of infection or by medical treatment. Most of the cases in the arthritic group were infectious in origin. While a small percentage was known to have syphilis, it was observed that anti-syphilitic treatment was of negative or doubtful value when given.

One hundred and twenty-six cases were considered as sacro-iliac joint conditions, and in eight cases of this group partial or definite obliteration of the joint was shown by X-ray. It was noted also that as the degree of obliteration of the joint increased, the pain experienced by the patient decreased. Ordinary sacro-iliac supports afforded definite relief of symptoms in the majority of cases, but a small number seemed to resist all forms of treatment.

There were three cases in which the coccyx had been removed by operation, with indifferent results. None of them had been entirely relieved, and two had not been improved. Two hundred one cases showed on roentgenograms evidences of congenital anomalies consisting of the following: Sacralization of the fifth lumbar transverse process; elongated fifth lumbar transverse process; spina bifida occulta; six lumbar vertebræ; abnormal angulation of articular facets.

J. N. Ané, M.D.

THE THYROID (THERAPY)

Serious Thyrotoxicosis in a Basedow Case Treated with Intravenous Injections of Sodium Fluoride. Leon Goldemberg and J. Horacio Maggi. Prensa Méd. Argentina, July 10, 1931, XVIII, 169, 170.

Goldemberg was the first to introduce the use of fluorides orally or intravenously in cases of hyperthyroidism, or Basedow's disease. He uses sodium and ammonium fluoride orally and sodium fluoride intravenously. He and Maggi present here a case, which in spite of anything done, including one treatment with radiotherapy, continued getting worse. After the second intravenous injection of sodium fluoride, the symptoms gradually subsided until the patient reached normalcy.

The authors' method consists of giving an initial dose of 3 c.c. and increasing it 1 c.c. daily until the patient feels better and then decreasing the dose according to the results.

N. G. Gonzalez, M.D.

Congenital Myxedema: Radiologic and Clinical Observations. B. Lunardi. L'Ateneo Parmense, May-June, 1931, III, 169-176.

The author describes a case, not entirely typical, of myxedema, in a boy 15 years of age, which was studied radiologically and which presented numerous interesting diagnostic questions. To which of the various forms of osteodystrophia was it to be ascribed?

There were lacking the special characters of acromegalia (for example, micromyelia), like-

wise, the signs of multiple fracture and osseous deformity which might suggest an imperfect belated osteogenesis; the special manifestations of Ollier's disease, as well as those of dyscondroplasia, properly so-called, were absent. Nor did rickets come directly into question, although certain streaks of thickening in the metaphysis of the femur, radius, and tibia suggested a rachitic form. Likewise, the alterations of the distal extremities of the ulna and radius were indicative of a rachitic connection. These, however, were not the predominant signs. The character of the epiphyses observed in the radiogram of one of the coxofemoral articulations suggested a youthful dystrophy of the epiphyses; but, on the other hand, there were absent numerous characteristics of this form of epiphysitis, principally the crushing of the nucleus and its fragmentation in island-like masses.

The picture is undoubtedly that of a hypothyroidism, which has produced or determined retardation of the nuclei of ossification. Lack of proper nourishment may have influenced the course of the disease, but how is a greater involvement of one bone than another to be explained, as seen in the tibia, in which the nucleus of the anterior tuberosity is entirely lacking, while that of the superior is normal?

Solution of the problem, the author concludes, lies in the assumption of a simultaneous development of myxedema and rickets, in the same manner that we find the former disease associated with mongolism. This fact is of interest both to the upholders of the theory of endocrine disturbance in the etiology of rickets and to those who invoke alterations of the thyroid as well as to those who regard the disease as a pluriglandular disturbance.

W. W. WHITELOCK, Ph.D.

THE TONSILS

The Radiologic Treatment of Malignant Tumors of the Tonsils. E. Berven. Strahlentherapie, Sept. 12, 1931, XLII, 113-135.

The author divided his cases of malignant neoplasms of the tonsil into four groups: Carcinoma, lympho-epithelioma, sarcoma, and mixed tumors. He analyzes in this paper 42 patients with carcinoma of the tonsil observed for from three to twelve years, and 8 cases of carcinoma treated in 1930; 4 cases of lympho-epithelioma; 35 cases of sarcoma, and 5 cases of malignant mixed tumors. The latter were also observed for from three to fifteen years. In all patients free of symptoms for more than three years the diagnosis was verified by biopsy.

From 1919 to 1927, 42 carcinoma cases were treated. Of these, 33 were ulcerated, 6 were not ulcerated, and 3 presented papillary growth. They all metastasized early. From 1919 to 1924, they were treated mostly by X-rays from the outside and radium screens placed on the tumor itself on the inside. Of 28 cases treated in this manner, not a single permanent cure could be obtained and they were free of symptoms for less than three years. It is mentioned that Coutard is the only one obtaining good results with roentgen rays in this type of patient.

Beginning in 1924, a new treatment technic was used. Radium was applied over three or four fields, one over the neck on the side of the tumor, one over the opposite side, one over the posterior neck, and one over the cheek. Six tubes 11×2.5 mm., 500 mg.-hr. each, filtered through 0.35 mm. Au + 0.3 mm. Pt = 1.1 mm. Pb, were placed over a circular area about 5 cm. in diameter. The applicator brought the total filtration up to an equivalent of 5 mm. of lead. The surrounding tissue was protected by 6 cm. of lead. The distance between applicator and skin amounted to 6 centimeters. The depth doses with the applicator were very satisfactory; for instance, about 30 per cent of the surface intensity reached the tonsil from the area on the same side.

The physicist of the institute suggested a new unit to express the dose, the Curie intensity, which is defined as follows: The unit for the gamma radiation intensity is that intensity present at 1 cm. distance from a radium applicator containing 1 gram radium element in equilibrium with its products of decomposition and where the source of radiation is filtered in all directions by 0.5 mm.

only. The dimensions must be so small that the source of radiation can be considered a point.

With the applicator described by the author, about 30 gram-hours can be applied as total dose on the skin at the same side on which the tumor is located. Through the opposite side 20 gram-hours may be given, about 20 gram-hours through the neck field, and about 10 gram-hours over the cheek area. The daily dose usually does not exceed 6 gram-hours. This means that the total irradiation takes from thirteen to fourteen days. It is sometimes advisable to arrange for intervals in order to avoid systemic reactions. The patient must be carefully observed, of course, during this course of treatment.

If an area receives a total dose of 40 gram-hours applied during six or seven days with intervals of one or two days, giving daily six hours, the skin reaction corresponds to the radio-epidermitis of the French authors. The ulcerating area in the center of the treated field is about 3×3 centimeters. This reaction begins about the middle of the fourth week and is usually healed at the end of the seventh week. With a dose of 30 gram-hours one obtains only reddening and desquamation of the skin without complete ulceration, while after 20 gram-hours there is only an erythema. Incomplete and temporary epilation occurs following 20 gram-hours but becomes complete after 40 gram-hours. The reaction in the tumor corresponds to the epidermitis described by Coutard. It is necessary to watch these reactions very carefully as well as the reduction of the size of the tumor. A second treatment should be given only if there is no further reduction and this will be about four to six weeks after the first series.

In order to take care of the remaining tumor tissue one might continue radium therapy as carried out in the first series or apply radium tubes to the surface, implant seeds into the tumor, or remove it by the endotherm knife.

If surface application to the tumor is decided upon, four radium tubes, about 20 mm. long, containing 25 mg. radium element filtered through gold and platinum equivalent to 1.1 mm. of lead, are used. The dose varies from 450 mg.-hrs. according to the individual requirements. Implantation is carried out by means of radium needles containing 10 mg. radium element, having a length of 15 mm., a diameter of 2.2 mm. and combined gold and platinum filtration equivalent to 0.9 mm. of lead. After application of cocaine the needles are inserted into the remaining tumor mass. The injection of a local anesthetic is avoided if possible. In some cases the endotherm knife was also used. The results obtained were as follows: 28 cases were treated from 1919 to 1924. Sixteen, or 57.1 per cent, were not improved; 5, or 17.9 per cent, were improved, one of these over two years; 7, or 25 per cent, were free of symptoms for from two to seventeen months and died from recurrence. Fourteen cases of carcinoma were treated with the new technic from 1923 to 1927. Four, or 28.6 per cent, did not show any improvement; 4, or 28.6 per cent, were improved, one case living nearly four years; 2, or 14 per cent, were free of symptoms thirteen months and twenty-seven months, respectively; 4, or 28.6 per cent, were free of symptoms for three, four, four and one-half, and five and three-quarters years, respectively. Four cases of lympho-epithelioma were treated during the same period. One was free of symptoms for six months and died from recurrence; 3 are living three, four, and five years, respectively, since the treatment. The lympho-epithelioma, much more sensitive than the carcinoma, was treated with the technic used for sarcoma which will be outlined later. Analysis of the statistics shows the enormous influence of the stage of the disease; while, for instance, 50 per cent of the cases belonging to Stages 1 and 2 remained free of symptoms for three years, there was not one case of primary cure in the group belonging to the third stage.

Thirty-five cases of sarcoma were seen. Among these, 29 tumors were not necrotic, 6 were necrotic (it appeared that the latter was the more malignant type). It occurred mostly during the age-period from twenty to thirty years. A combination of roentgen rays from the outside and radium contact application was applied. In the earlier years the author used moderate potential and aluminum filter,

while lately 160 to 170 K.V., 0.5 mm. Cu + 1 mm. Al, corresponding to a half value layer of 0.85 mm. Cu, were employed. In a field of 10 × 10, 700 r corresponded to the H.E.D. Sometimes a different filter combination giving a half value layer of 1.42 mm. Cu was used. The H.E.D. corresponded to about 100 r, F.S.D. 40 cm., 10 × 15 sq. cm. field of entry. Small doses of from 1/6 to ¼ H.E.D. are given first. Quite often the tumor reduces definitely after the first few treatments. The dose is increased only if no further reduction can be obtained by these small doses. One must carefully watch the tissue surrounding the tumor in order to avoid excessive inflammation followed by edema. The patients usually receive during two weeks a total of from 1 to 1½ H.E.D. over one or both sides of the neck.

After the tumor has reduced enough in size, radium application is carried out. As a rule four radium tubes are used of 20 mm. length, containing 25 mg. radium element. The gold-platinum filter corresponds to 1 mm. of lead. Doses of from 250 to 1,700 mg.-hrs. are applied to the tumor surface. Of 35 cases treated from 1916 to 1927, 6, or 17.2 per cent, were not improved; 4, or 11.4 per cent, were improved from one and one-half to four months; 10, or 28.6 per cent, were free of symptoms but died within three years; 15, or 42.8 per cent, were well for from three to twelve years. The influence of the stage of the disease on the final result is also quite evident in these statistics. The author emphasizes that the surgical removal of the tonsillar sarcoma is rather risky. In four out of seven cases local recurrence developed three weeks after tonsillectomy and in two other cases metastases appeared. Biopsies in this type of tumor should be taken, therefore, with great caution.

Five cases with mixed neoplasms were treated with the same technic as the carcinoma. After the tumor had reduced in size the remaining mass was usually removed by the endotherm knife. Two cases were very radioresistant. Three reduced in size following irradiation and could then be removed. Of these three patients, one is alive four years, one four and three-fourths years, and one five years, respectively, after the treatment.

In conclusion, the author discusses the difficulties in the differential diagnosis between syphilis and malignant tumor of the tonsil. Very often there may be a combination of both. It is dangerous, however, to wait with the proper treatment in case of a malignancy. One must also remember that anti-syphilitic treatment can reduce the necrosis and the size of a malignant tumor, particularly in cases which have syphilis in addition to the malignancy. The prognosis in these cases seems to be rather poor.

ERNST A. POHLE, M.D., Ph.D.

TUBERCULOSIS (DIAGNOSIS)

Skiagraphy in the Diagnosis of Pulmonary Tuberculosis. M. Kesava Pai. Antiseptic, July, 1931, XXVIII, 506-509.

In the diagnosis of tuberculous hilus disease, circumscribed pneumothoraces, pleural effusions, and occluded cavities, the X-ray has great advantage over our present-day methods of physical diagnosis. Roentgenography is likewise of value as a means of keeping permanent records of chest conditions at different times in the course of treatment.

In the study of roentgenograms of chest diseases it is absolutely essential that the appearance of the normal chest be known and recognized. Pathologic research has proved that tuberculous pulmonary lesions—healed, healing, or active—are present in the vast majority of adults, especially in the region of the hilus. Therefore, a certain degree of "hilus shadow" can be considered normal for all practical purposes. It should be remembered that the hilus shadow is made up by a number of structures, including bronchi, lymphatic glands, and blood vessels. Fluoroscopic examination reveals information regarding the movements of the diaphragms and chest wall, the lighting up of the apices, and the relative translucency of the lungs during inspiration and expiration.

In the pathologic chest a ground glass appearance on the roentgenogram indicates the

presence of thickened pleura or a very thin layer of effusion. The author advises that in the application of artificial pneumothorax treatment a skiagram of every patient be taken and examined before applying treatment. Pneumothorax collapse is a dangerous procedure to be adopted when there is active disease in the opposite lung, for it is a common experience to find deep disease on the collateral side, as seen on the roentgenogram, when it was not suspected by physical examination. The author briefly discusses the roentgenographic diagnosis of various pulmonary conditions and includes reproductions of roentgenograms.

J. N. Ané, M.D.

Diagnosis and Treatment of Renal Tuberculosis. Mario Donati. Revista Med. Cubana, October, 1931, XLII, 1202-1218.

According to Lasio, in 10 per cent of cases of pulmonary tuberculosis, urogenital tuberculosis is present, and in from 40 to 80 per cent, renal tuberculosis accompanies a tuberculous lesion elsewhere. Since renal tuberculosis seldom manifests itself save in advanced stages, the author advises the examination of urine for the Koch's organism whenever it is known that a tuberculous infection exists elsewhere. He classifies the lesions as: (1) Caseous ulcerative type; (2) nodular type—either circumscribed or disseminated, and (3) fibrous type.

The majority of cases of renal tuberculosis occurs between the ages of twenty and forty years. The infection is usually unilateral for a long time. At an early stage, there is a specific secondary inflammation, either of the ureter, of the bladder, or both. The symptoms are usually as follows: Frequency, pain (either unilateral or bilateral), painless bloody urination, symptoms pointing toward pyelonephritis or pyelonephrosis, and marked acidity of the urine. Cystoscopies and pyelograms are of great help in the diagnosis.

The treatment of choice in unilateral or even in bilateral cases in which the function of the better kidney is good is nephrectomy. Medical treatment does not yield good results. The author claims 100 per cent cure in all his nephrectomies.

N. G. Gonzalez, M.D.

The Co-existence of Pulmonary Tuberculosis and Other Intrathoracic Lesions. Alexander Josewich. Med. Bull. Veterans' Administration, September, 1931, VII, 803-807.

The author believes that the possibility of the association of tuberculous and non-tuberculous intrathoracic lesions has not received due consideration because of the stress that has been put on the differential diagnosis of these conditions by medical literature in general.

Bronchitis, either of the acute or chronic variety, is frequently found associated with tuberculosis. The presence of prolonged bronchitis should always lead the clinician to suspect the association of frank or marked tuberculosis. In some cases of advanced tuberculosis with associated chronic bronchitis, the diagnosis of bronchitis alone is made, on account of constant failure to find the tubercle bacilli. In attempting to come to a true conclusion in such problems, it is to be remembered that although the roentgen examination shows no dependable evidence of bronchitis, the hidden areas of tuberculosis, which may not be detected by physical examination, are at times easily revealed by the roentgenologic examination. In the study of these cases the author emphasizes the necessity of employing the diagnostic triad of time, perseverance, and common sense.

Although subacute and chronic interstitial pneumonitis were accurately described decades ago, these conditions have received especial attention during and subsequent to the war. Confusion resulted in many cases and non-tuberculous lesions were considered tuberculous. Of late, however, the detection of these conditions has served to definitely rule out the existence of tuberculosis in interstitial pneumonitis. While in a series of interstitial pneumonitis the author has found less than 5 per cent associated with tuberculosis, he believes that the possibility of the co-existence of these lesions should be kept in mind.

In like manner, carcinoma of the lung or foreign bodies in the respiratory tract may be found associated with active tuberculosis. While the fibrotic changes which take place about a foreign body should not be considered tuberculous, the possibility of the association should be remembered. Aneurysms, mediastinal tumors, and paravertebral abscesses are other conditions found associated with tuberculous involvement. In the author's opinion, the most evident condition should not be allowed to occupy the entire field in such a manner that associated tuberculous lesions are overlooked.

J. N. Ané, M.D.

A Case of Tuberculosis of the Third Portion of the Duodenum, Secondary to Tuberculosis of the Adjacent Retroperitoneal Lymphatic Glands. Rodolfo Viviani. Riv. di Patolog. e Clin. della Tuberculosis, July 31, 1931, V, 521-537.

It is well known that tuberculous ulcers may, although infrequently, be located in the duodenum. As a rule, however, these are secondary to pulmonary tuberculosis, a condition accompanied with great frequency by intestinal ulcerative conditions of the same nature, particularly in those parts which are most generously provided with lymphatic apparatus, in which the disease process in question locates itself with predilection. It is a familiar fact, also, that tuberculosis may appear, although rarely, exclusively in the duodenum.

On the other hand, tuberculosis transmitted to the duodenum directly from the adjacent tuberculous glands represents an exceptional anatomic finding, according to the literature.

In establishing the highly anomalous nature of the case which he reports, the author confines himself mainly to radiologic procedure and findings, together with a few clinical data. The anatomo-pathologic aspects are discussed by another investigator in an article in the same issue.

The author's observations demonstrate two noteworthy facts: First, that the duodenal contents may repeatedly and for a long time invade the biliary channels without causing appreciable lesions; second, the peritoneal serosa does not always react with the customary violence to the invasion of infectious material but may manifest relative tolerance. It is possible for an acute generalized perforative peritonitis to arise, accompanied by a clinical symptomatology, objective or subjective, relatively attenuated and under pathologic conditions permitting the prolongation of life for a considerable time beyond the limits usually imposed by the process in question.

W. W. Whitelock, Ph.D.

TUBERCULOSIS (THERAPY)

The Effect of the Sea Climate on the Red Blood Picture and Tests for the Climatic Reaction on the Sea in Surgical Tuberculosis. M. Bracher. Strahlentherapie, May 20, 1931, XL, 650-657.

Children from large cities brought to the sea shore showed a definite increase in hemoglobin, averaging about 10 per cent. Improvement in the blood picture was also seen in patients with surgical tuberculosis. The sedimentation reaction proved to be a valuable guide in prognosis. The mechanism of the climatologic reaction is discussed.

Ernst A. Pohle, M.D., Ph.D.

The Asthmogenic Significance of Pulmonary Cavitation in Tuberculosis Associated with Asthma. J. T. Malone. Med. Bull. Veterans' Administration, September, 1931, VII, 799-802.

The author has previously reported a series of ten cases of active pulmonary tuberculosis and associated asthma in which the presence of pulmonary cavitation suggested an etiologic factor of asthmogenic consideration from the standpoint of an existing bacterial sensitization, produced by a focus of mixed infection in retained cavitary secretions. Demonstration of the existence of bacterial allergy was accomplished in these cases by the marked reaction to the injection of a non-sensitized bacterin of mixed bacterial composition employed in small graduated doses. In this regard Eiman believes that 50 per cent of the patients suffering from bronchial asthma are sensitized

to the proteins of their own bronchial secretions. Extensive investigation, however, has failed to produce satisfactory evidence of the existence of a sensitizing protein of the tubercle.

The author reports twenty additional cases of pulmonary tuberculosis associated with bronchial asthma, presenting, roentgenologically, evidences of apical cavitation. Two cases were suggestive of bronchiectasis as an additional complication, based on the X-ray evidence of lower lobe dilatation of the bronchi. Sputum positive for the tubercle bacillus was demonstrated in every case. Cutaneous and intra-cutaneous protein tests, which were made to identify the suspected bacterial allergy, were of little diagnostic value. Following the adoption of the subcutaneous injection method, the reactions obtained were strongly suggestive for bacterial allergic response. This also was abandoned following the production of a pulmonary hemorrhage in one case, with a marked extension of the tuberculous lesion and rupture of the cavity wall. Artificial pneumothorax was considered necessary in this case and when satisfactory compression of the apical cavity occurred, all asthmatic symptoms ceased. This patient has been under constant observation for four years following the pneumothorax and at no time has demonstrated a return of asthmatic symptoms. Although this is the only case in the author's series treated by artificial pneumothorax, he considers the question of the advisability of the employment of artificial pneumothorax in the treatment of severe asthma, either associated with unilateral cavitation of tuberculous etiology, or in severe asthmatic cases of non-tuberculous background in which there is evidence of retained secretions.

J. N. Ané, M.D.

TUMORS (DIAGNOSIS)

Roentgen Diagnosis of Infected, Intraperitoneal Hematoma. Gösta Gråberger. Acta Radiologica, 1931, XII, No. 66, 15, IV, 152-156.

In Upsala, roentgen examination of acute and subacute abdominal cases is very commonly employed. The patients are screened, and the movements of the diaphragms and the appearance of the lungs are carefully observed. Plain films of the abdomen are studied for free gas in the abdominal cavity, distention of the small bowel with gas, the outline of the psoas muscle, and the layers of fat in the flank. A barium enema usually concludes the examination.

Laurell has already reported on the appearance of the lateral abdominal wall in these cases. Normally there are visible in the flank four layers of fat: (1) Subcutaneous; (2) and (3) intermuscular, and (4) subperitoneal. When abdominal or retroperitoneal processes reach the lateral abdominal wall, the hyperemia and edema of the subperitoneal fat cause so much absorption of the X-rays that this layer of fat either becomes much less plainly visible or can not be seen at all.

The author reports the course of a case of acute appendicitis in a man 47 years old. Operation was done twelve hours after the onset of the illness and a gangrenous appendix removed. There was considerable turbid fluid about the cecum, but no bacteria were found in it at microscopic examination.

The patient did not do well, and five days after the operation came to roentgen examination with a diagnosis of ileus. Both diaphragms moved freely. Two dilated loops of small intestine were seen in the lower abdomen. A homogeneous shadow in the right flank displaced the cecum and ascending colon medially. The subperitoneal layer of fat was clearly visible. A diagnosis of intraperitoneal hematoma was made.

The patient became worse and four days later was re-examined under a clinical diagnosis of peritonitis. At this time the right diaphragm showed a marked lagging. The homogeneous shadow in the right flank was unchanged but, from the crest of the ilium to the liver, the subperitoneal layer of fat was invisible. A diagnosis of infected intraperitoneal hematoma was made.

Immediate operation was done. About two liters of coagulated blood without grossly visi-

ble pus were found in the right side of the abdomen, extending upward under the liver. At microscopic examination bacteria were found in the coagulated blood removed from the abdomen. Subsequent recovery was uneventful.

A. L. HART, M.D.

Malignant Pheochromocytoma of the Adrenals. E. S. J. King. Jour. Path. and Bacteriol., July, 1931, XXXIV, 447-452.

A hitherto undescribed form of pheochromocytoma affecting both adrenals is reported. Two types of cells were present; typical pheochrome cells and anaplastic cells, with all stages of transition between these types. Metastases were numerous to the soft-tissue organs as well as to the bones.

E. C. VOGT, M.D.

Experimental Tar Tumors in the White Rat. A. F. Watson. Jour. Path. and Bacteriol., May, 1931, XXXIV, 301-306.

Skin tumors were produced in two male and two female rats by means of the periodic treatment with a gas works coal tar, each application of tar being preceded by a petroleum ether extract of rat tissues.

The tumors appeared from 415 to 551 days after the first application of tar, and in the males were squamous-cell carcinomas. One animal showed extensive metastases. The tumors in the female rats were of slower growth and only one of these showed local extension.

Inoculations of these tumors into normal rats were unsuccessful.

E. C. VOGT, M.D.

Intra-articular Endothelioma of the Synovial Membrane. Julio Diez. La Prensa Médica Argentina. Sept. 20, 1931, II, 487-500.

The author begins the discussion by calling attention to the fact that there are only seven reported cases of intra-articular endothelioma in the entire medical literature. He attributes the rarity of the growth to the fact that accurate diagnosis is difficult, even with the aid of the microscope. In Smith's case Ewing classified it as endothelioma and Mallory as fibrosarcoma with hyperplasia.

The purpose of the article is to bring out some histologic points which facilitate the diagnosis and to point out clinical facts which have been left out in previous reported cases.

The author makes mention of the fact that X-ray films clarify the diagnosis, but it is difficult to differentiate primary articular sarcoma. According to the author, the latter is more diffuse and grows rapidly. The benign growths should give no difficulty in differentiation.

Several photomicrographs are shown at different magnifications. One X-ray film is reproduced giving the shadow of the tumor. In the discussion of the X-ray findings, it is stated that the anteroposterior view in the author's case was entirely normal, while the lateral view showed the growth plainly.

In the line of treatment the author is in favor of high amputation. No mention is made of the use of deep X-ray or radium.

JOSEPH MALDONADO, M.D.

Multiple Teratomas of the Peritoneum. W. G. Barnard. Jour. Path. and Bacteriol., May, 1931, XXXIV, 389-391.

This is a case report of an ovarian teratoma with many secondary nodules scattered over the peritoneum.

The patient, 40 years of age, died four months after she first noticed an enlargement of the abdomen. How the dissemination took place was not clear, as there was no direct evidence of rupture of the primary growth.

E. C. VOGT, M.D.

Blood-sugar Regulation and Vegetative Tone in Malignant Tumors. Vittorio Romanin. Minerva Med., June 9, 1931, XXII, 870-876.

This is an experimental study on the sugar content of the blood of cancerous patients.

The results published show that the quantity of sugar present is well within the normal limits during the fasting stage; however, the glycohematic curve, after alimentation, shows a peculiar trend in the descending phase, the sugar content diminishing much more slowly than in normal subjects and persisting in noteworthy quantities even two hours after meals.

The author is of the opinion that this factor may possibly be of aid in the diagnosis of doubtful cases of malignant tumors and that a normal glycohematic behavior can almost definitely exclude the diagnosis of a neoplastic growth.

Comparative experiments for the study of the influence of the nervous systems lead the author to conclude that stimulation of either system shifts the normal glycohematic equilibrium in the same direction. Other factors, however, such as those present in the stimulation of the vagus nerve by pilocarpine, seem to lend credit to the existence of a parasympathetic excitability in the presence of malignant tumors.

L. Marinelli.

TUMORS (THERAPY)

Shall It Be Radium or Surgery in the Treatment of Uterine Fibroids? H. W. Hewitt. Jour. Michigan St. Med. Soc., March, 1931, XXX, 129-131.

Reduced to a practical basis, the indications and contra-indications for radium and surgery are as follows: radium may be used in intramural tumors not larger than a four months' pregnancy in women at or near the menopause, in patients whose physical condition has been depleted by hemorrhage, and in all patients in whom surgical measures are contra-indicated. Myomectomy is indicated in young women in whom child-bearing is a consideration, it being desirable to preserve ovarian function, and in whom other abdominal pathology necessitates a laparotomy. Hysterectomy is indicated in cases in which tumors are large, cause pressure, have degenerated, are subperitoneal or submucous, and in which adnexal disease, corpus cancer, or some lesion of doubtful nature exists. There is no competition between radium and surgery; each has its own field.

(*Note.*—X-ray therapy is mentioned at the outset of the article as the third method of treatment, but it is not discussed.)

W. W. Watkins, M.D.

The Influence of Roentgen Irradiation on the Metabolism of the Jensen Sarcoma. A. Löw-Beer and M. Reiss. Strahlentherapie, Sept. 12, 1931, XLII, 157-159.

The authors report the results of their investigations dealing with the metabolism of tumor tissue from one to five days following irradiation. They selected the Jensen sarcoma for their experiments. The tumor tissue was implanted under the abdominal skin of rats. As soon as the tumors had reached the size of a hazelnut, which usually occurred twelve days after the implantation, roentgen rays were applied. The exposure was confined to the tumor proper and the remaining part of the body was carefully protected. In view of the superficial location of the tumor, 120 K.V., 4 ma., 30 cm. F.S.D., and 4 mm. Al were used. The dose applied in one sitting amounted to 650 r. It appeared that the oxidation processes were considerably decreased following the application of this dose. This was shown by the fact that the glucolysis was considerably increased as compared with non-irradiated tumor tissue.

Ernst A. Pohle, M.D., Ph.D.

ULTRA-VIOLET LIGHT

The Effect of Ultra-violet Radiation on Sucrase. II.—The Rôle of Trytophan and Yeast Gums. G. Gorbach and K. Lerch. Biochem. Ztschr., 1931, CCXXXV, 259-266.

On dialyzing a yeast autolysate its sucrase activity increases during the first few hours, but, after 30 hours, it decreases very much and shows a continual gradual and steady loss after 48 hours. In the very beginning of the dialysis the dry residue decreases to a small fraction of its original value, and after 48

hours it decreases only slightly. The tryptophan content determined spectrophotometrically follows the same sort of curve. During the first hours of dialysis the activity per unit of dry weight runs parallel to the changes in tryptophan content, and the striking fall in activity after 30 hours is accompanied by a similar drop in tryptophan. The yeast gums, unlike the tryptophan, do not have a region of selective absorption, though the shorter the ultra-violet wave the more strongly it is absorbed. At a wave length of 270 mμ the gums have only 1/630 the absorbing capacity of the tryptophan. The inactivation of the sucrase is independent of changes in the gum content.

CHEMICAL ABSTRACTS.

Fluorescent Studies on Pathogenic Fungi in Various Spectral Ultra-violet Lights. G. H. Klövekorn and Otto Gaertner. Strahlentherapie, 1931, XLI, 370, 371.

The fluorescence of six micro-organisms was studied for the lines 3,660, 3,120, 3,020 and 2,650 Ångströms. While all showed fluorescence with all lines examined, 3,660 Å. proved to give the best results. *Mikrosporon audouini* and *Achorion quinckeaneum* showed the strongest fluorescence. For the diagnosis of mikrosporia this line is, therefore, most suitable.

ERNST A. POHLE, M.D., Ph.D.

Ultra-violet Radiation. V. C. Sudarsanam. Antiseptic, July, 1931, XXVIII, 531-539.

The sun was worshipped by the earliest tribes in history and even to-day holds a prominent place in the religious rites of many of the older races. Hippocrates established a health temple to Aesculapius, God of the Sun, Medicine, and Music. The priests, who were also physicians, used the natural agencies of air, light, and water in the cure of diseases and the pursuit of both physical and mental culture. Up to about fifty years ago, the virtues of sun, air, and light were forgotten. The author thus reviews the history of ultra-violet radiation.

The chemical reactions of ultra-violet rays may be divided into reactions of degradation, synthetic reaction, and double decomposition. The absorption phenomenon of the ultra-violet ray may be considered as one of the most important of its physical properties. Ozone absorbs ultra-violet rays very strongly. All glasses that contain metals of high atomic weight absorb most of the rays. "Vita glass," containing a large proportion of quartz, has been used in hospitals because of its property of transmitting most of the ultra-violet rays of sunlight.

In the presence of ultra-violet rays a lighted candle glows a bright blue, liver shows an intense yellowish fluorescence, suprarenals an orange red, and cerebral cortex a yellow. This property is especially valuable in distinguishing pearls. Japanese-cultivated pearls give a yellowish fluorescence, oriental pearls appear bluish, and artificial pearls show no fluorescence.

The theories advanced to explain the mode of action of ultra-violet radiations are as follows: (1) That the autonomic nervous system is directly influenced; (2) that rays penetrating as far as the capillaries of the corium are absorbed by the blood; (3) that some substance formed in the epidermis acts as a hormone. Continued irradiation of the skin produces pigmentation. Certain changes take place in the skin as a result of the absorption of ultra-violet rays. It has been proved that these rays convert the cholesterol in the skin into Vitamin D, which stimulates calcium, iron, and phosphorus absorption.

During general irradiation of the body there occurs dilatation of the surface capillaries, and a comparative disengorgement of internal vessels results. Blood serum and blood corpuscles absorb all rays less than 4,500 Å. There is a slight increase in the red and white cells and in hemoglobin. Also, an increase in the immunizing and bactericidal properties of the blood occurs. Reflex contraction of the involuntary muscles results under irradiation, and this property has been tried in some cases of constipation, with benefit. Loss of appetite is likewise relieved by irradiation through the stimulation of the digestive glands. The analgesic effect of the rays is more pronounced with the carbon arc and can be read-

ily seen when cases of herpes or neuralgia are treated.

While no single therapeutic agent can be a panacea, the ultra-violet rays when properly used by one who understands the biologic effects of irradiation, are found to act as a specific cure in some conditions; when used with other forms of therapy, ultra-violet radiation is certainly a valuable aid.

J. N. ANÉ, M.D.

NOT OTHERWISE CLASSIFIED

Roentgen Findings as Evidence in Medico-legal Cases. William A. Evans. Jour. Michigan St. Med. Soc., May, 1931, XXX, 329-339.

Contradictions in medical testimony are often credited to bias, prejudice, or actual dishonesty on the part of the witness, yet conflicts in statements many times are based on honest differences in opinion: there are certain moot questions regarding which authorities hold opposing views and there are differences in opinion due to variations in quality and degree of training and experience.

In roentgenology, errors of inexperience can be grouped in three classes: first, interpretation of normal structures as pathologic or traumatic, such as blood vessel grooves on shafts of long bones or skull bones, irregular calcification of costal cartilages, variation in rib density due to overlying pulmonary shadows; second, interpreting anomalies or variations in structure as disease or injury, such as accessory tarsal scaphoid or prehallux as fracture, non-united astragaloid tubercle as fracture (true fractures do occur at this point), hamstring sesamoids as avulsed fractures or loose bodies in knee joints, sesamoid at the acetabular margin as fracture of the ilium, occult spina bifida as fracture, rudimentary ribs at the first lumbar as fractured lateral processes, bipartite carpal scaphoid as fracture; third, interpreting pathologic or disease changes as injury or acute trauma. The most common mistake in this last group is in interpreting chronic inflammatory changes in the spine as being due to injury, or the deformity of Pott's disease as due to trauma. Other sources of misinterpretation are: the connection of trauma with malignancy, and the relation of trauma and arthritis.

The increasing burden being placed on employers for the medical care of their injured help and the resulting compensation will necessitate action on their part to reduce the number of claims or to lessen the awards. Comprehensive preliminary examinations will become necessary, which will involve, in addition to careful physical examinations, roentgen studies of the chest and spine.

W. W. WATKINS, M.D.

Eunuchism of Feminine Type: Diabetes Insipidus: Thyroid Insufficiency: Hypophysis: Diencephalic Cachexia. Mario Schteingart and Alberto Arnaudo. Prensa Méd. Argentina, Aug. 20, 1931, XVIII, 351-357.

The authors present a case of a man 34 years old with this complex syndrome. At the age of five, following pneumonia, he grew very rapidly but remained below normal mentally. When 16 years of age, he developed polydipsia and polyuria, urinating as much as seven quarts a day. His whole physical development was feminine in type; the genital organs atrophied; there was diaphyso-epiphyseal hypertrophy, with osseous transparency, articular hyperextension, myxedematous infiltration, dry, hard hair, acrocyanosis and cold extremities, low metabolic rate, gradual loss of weight, etc. A roentgenogram showed a rectangular sella turcica with hypertrophy of the postclinoid apophysis. The patient was under observation for three years and during that time there was a gradual loss of weight, the general condition growing worse.

N. G. GONZALEZ, M.D.

Psychic Regulating Apparatus: Psychic Disturbances (Activity, Emotions, etc.) in Mesocephalic and Diencephalus. Hypophyseal Lesions. Armando Camauër. Prensa

Méd. Argentina, July 30, 1931, XVIII, 249-255.

The purpose of this paper is to show that there are areas in the brain which control the psychic part of human beings. The author reviews cases presented by other neurologists which tend to prove that in lesions of the tubero-infundibulo-hypophyseal region there are frequently found disturbances of psychic activity without any alteration of the intellectual and mental part. The disturbances are marked psychic retardation, changes in character and disposition, and a marked oscillation from gay to sad and vice versa. The author believes that we can conclude that there exists in the region of the third ventricle, in the periventricular and mesocephalic constellation a regulatory apparatus of psychic function. He presents the case of a man 65 years old, with a family history of syphilis, who came to him because of heaviness in the leg and psychic disturbances. A radiograph showed the presence of a lesion pressing down on the sella turcica. The Wassermann reaction was 4+. The conclusion was syphilis.

N. G. Gonzalez, M.D.

CHEMICAL ABSTRACTS

The Modification of the Permeability of the Cell Membrane by the Combined Effect of X-rays and Photochemical Catalysts. Lydie Tsebrikow. Arch. Intern. Méd. Exper., 1930, V, 641-648.

The photochemical catalysts, colloidal Fe, colloidal Ag, or colloidal Au, appear to augment the effect of X-rays upon living tissues, both normal and cancerous. The permeability of the cell membrane is increased and the production of photochemical reactions is facilitated. The effect is not produced by trypan blue or trypaflavine.

Chemical Abstracts.

An Experimental Study of the Natural Widths of the X-ray Lines in the L-series Spectrum of Uranium. John H. Williams. Phys. Rev., 1931, XXXVII, 1431-1442.

The half widths at half maximum of the rocking curves in parallel positions of the double X-ray spectrometer with calcite crystals reflecting in the first order have been investigated as a function of wave length. This function is shown to be linear. The rocking curves of U L_α in three different anti-parallel positions of the instrument give a natural width practically independent of the dispersion. The natural widths of U L_α and U L_β show no dependence on voltage. The half widths at half maximum of 12 lines in the U L-series spectrum are given. The results are discussed from classical and quantum theory points of view.

Chemical Abstracts.

X-ray Investigation of the Crystals of Copper Formate Dihydrate. Mata Prasad and Hiralal M. Mapara. Indian Jour. Physics, 1931, VI, 41-49.

The structure of Cu formate dihydrate was studied by the rotating crystal method. The dimensions of the unit cell are *(a)* 8.952, *(b)* 6.726, *(c)* 8.235 Å.U.; the crystal belongs to the space group C^5_{2h}; the cell contains four molecules and they are asymmetric; the molecules may lie near the *(ac)* face and may be connected with each other by water molecules lying in the *(bc)* face.

Chemical Abstracts.

The Action of Radium Emanations on Bacteria, the Filterable Virus of Peripneumonia and Bacteriophage. B. P. Ebert and L. H. Peretz. Zentralbl. f. Bakteriol. Parasitenk. u. Infedtionskr., 1931, 1 Abt., CXXI, 258-267.

Trypsin is very resistant to Ra emanations; bacteriophage is equally resistant. Vegetative cells of bacteria and the filterable virus of peripneumonia of cattle are much less resistant, although spores are resistant. This points toward bacteriophage being enzyme-like in nature.

Chemical Abstracts.

X-ray Study of Very Pure Iron. O. L. Roberts. Phys. Rev., 1930, XXXV, 1426.

Carbon-free Fe was prepared from pure $Fe(NO_3)_3$. X-ray diffraction patterns show that face-centered cubic structure exists at 921°.

CHEMICAL ABSTRACTS.

Action of Low-speed Electrons on Photographic Emulsions. R. E. Burroughs. Rev. Sci. Instruments, 1931, II, 321-328.

Electrons from a heated cathode were accelerated by a potential to an anode containing a slit. The electron beam passing through the slit was focused by a magnetic field on the photographic emulsion being studied. The experiments performed brought out the following facts: (1) No electron impacts were recorded when the electron beam was not distinctly defined by a visible radiation from the residual gas; (2) the lowest voltage recorded in each case was the lowest energy electron that would produce a visible radiation in the residual gas of the electron tube; (3) the lowest potential which would cause the electron to render the photographic plate developable was determined by the composition of the residual gas and its pressure and in no way indicated that it was related to a characteristic of the photographic emulsion.

The conclusion is drawn that the exposure produced on a photographic emulsion is not due to the sensitive grain receiving the electron's energy directly, but is due to the radiations excited by impacts of the electrons with the residual gas.

CHEMICAL ABSTRACTS.

Scattering of X-rays in Argon. G. Herzog. Ztschr. Physik, 1931, LXIX, 207-234.

The variation with scattering angle of the intensity of X-rays scattered in A is investigated photographically. The results agree with theoretic calculations of Waller and Hartree and confirm the atom model assumed by them. Herzog questions the validity of the analysis by which Compton deduced from experiments on X-ray scattering the distribution of charge in atoms and favored the interpretation of $\psi\psi^*$ as a probability of occurrence of an electron.

CHEMICAL ABSTRACTS.

X-ray Analysis of Slate. Harold V. Anderson and Kenneth G. Chesley. Am. Jour. Sci., 1931, XXII, 103-112.

The interplanar spacings as obtained by the powder method are given tabularly for slates from seven localities and the principal spacings for minerals which were found to be present in slate. The Al silicate in slate is cyanite (not kaolin or andalusite). Quartz, corundum, cyanite, and mica preponderate.

CHEMICAL ABSTRACTS.

Effect of Chemical Combination on the X-ray Spectra of Copper. E. A. Owen and T. E. Williams. Proc. Royal Soc. (London), 1931, A, CXXXII, 282-295.

The K_α doublet of Cu in Cu and its oxides and in a number of intermetallic compounds and solid solutions has been investigated. In all cases there was no change found in the wave length of the $K_{\alpha 1}$ line, or in the separation of the lines in the doublet. It is pointed out that whereas these results are probably true for the intermetallic compounds and solid solutions, they do not hold for the oxides of Cu because of the decomposition that takes place when the latter are placed on the target of an X-ray tube. The positions of the K absorption edges of Cu in the same substances together with a number of inorganic compounds of Cu were determined. The edge in Cu and in the cuprous salts corresponds to the wave length 1377.4 X. U. and was the same as that obtained with the intermetallic compounds and solid solutions. In all the inorganic cupric salts the edge had moved toward the shorter wave lengths. The shift amounted on the average to 1.1 X. U., which corresponds to 7.1 v. When an electron is removed as in the formation of cupric compounds a re-arrangement of the remaining

electrons takes place, which causes a change in the energy of the electrons in all the orbits, including those of the K group. Thus the energy necessary to eject a K electron is increased, causing the K absorption edge to move to a shorter wave length. If the formation of an intermetallic compound involved two Cu electrons it would be revealed by a shift in the absorption edge. Since there is no shift the Cu atom in intermetallic compounds must be in the cuprous state.

CHEMICAL ABSTRACTS.

The Nature of the Radiations Active in the Phenomena of Photosensitization. Jean Cuzin. Bull. soc. chim. biol., 1930, XII, 1401-1409.

Eosin and methylene blue exert a tonic effect upon the isolated rabbit intestine which interferes with the mild effect of radiation. Hematoporphyrin is sensitive to the entire range of the spectrum studied, but is less sensitive in the yellow, green, blue, and ultraviolet.

CHEMICAL ABSTRACTS.

Further Investigation of the Magnesia-zircon Series Based on X-ray and Microscopic Examination. A. L. Roussin and J. H. Chesters. Trans. Ceram. Soc., England, 1931, XXX, 217-224.

Ignited mixtures of magnesite and zircon were found to contain at least two additional minerals, occurring in maximum amounts in the 20-80 and 50-50 mixtures by weight. The mineral found in the 20-80 mixture was similar to zircon microscopically, but had a different X-ray pattern.

CHEMICAL ABSTRACTS.

Influence of Chemical Binding on the X-ray Absorption Spectrum. Richard Swinne. Wiss. Veröffentlich. Siemens-Konzern, 1931, X, No. 2, pp. 89-94.

It is known that the X-ray critical absorption discontinuities of an element sometimes exhibit varying degrees of fine structure, depending on the chemical combination. The author points out that London's theory of chemical binding predicts for some cases such energy terms as will account for the fine structure, but that these will not be obtained with polar binding or with neutral free atoms. It is also known that rhombic S is an exception to the general rule that the wave length of the absorption discontinuity of an element in the uncombined state is generally longer than when the element is combined. The author attributes this to the high degree of association of rhombic S.

CHEMICAL ABSTRACTS.

X-ray Investigations on the Crystal Structure of Hardened Steel. Einar Ohman. Jour. Iron Steel Inst., London, 1931, advance copy No. 12, 19 pages.

An X-ray study of quenched steels confirmed the existence of the tetragonal phase the axial ratio of which increased with increasing C content. From a consideration of these data it is concluded that martensite consists of a solid solution of C in body-centered Fe. On effective quenching the tetragonal phase has the same composition as the parent austenite, as proved by the direct relationship between C content and space-lattice dimensions. It appears probable that the C atoms dissolved in α-Fe form a complex substitutional group in which two C atoms replace one Fe atom. On tempering, the tetragonal phase decomposes continuously with a progressive decrease in axial ratio. The causes of the hardness of martensite are discussed. Forty-seven references are included.

CHEMICAL ABSTRACTS.

X-ray Investigation of Certain Nickel Steels of Low Thermal Expansion. G. Phragmen. Jour. Iron Steel Inst., London, 1931, advance copy No. 14, 10 pages.

Precise measurements of the lattice dimensions of Ni-Fe alloys at various temperatures proved that the low coefficient of expansion of alloys containing about 36 per cent Ni is a

property of the face-centered cubic lattice of this compound and is, therefore, not due to a two-phase reaction. The study was made on alloy strips, which could be heated electrically, in a camera utilizing the Bragg focusing principle. At room temperature the maximum lattice parameter occurs in alloys containing about 38 per cent Ni. It is suggested that the specific-volume anomaly may be connected with the anomaly of expansion.

CHEMICAL ABSTRACTS.

Acetylene Electrocondensation by Means of β-rays. W. Mund and J. C. Jungers. Bull. soc. chim. Belg., 1931, XL, 158-176.

In the electrocondensation of C_2H_2 with β-rays, the ratio M/I is equal to 26. A general theory of radiochemical phenomena has been developed. A crystalline structure with complex ions is proposed to explain the properties of the acetylene polymerization product and its mode of formation in the presence of inert gases.

CHEMICAL ABSTRACTS.

PHYSICAL ABSTRACTS

The Aging of Ions in Air and Nitrogen. John Zeleny. Phys. Rev., Sept. 1, 1931, XXXVIII, 969-976.

Previous work on the mobility of aged ions in air has been extended to the measurement in air and in nitrogen of mobilities of ions at different short ages. The ions were produced by alpha-rays directly in the field used for their measurement, and the average age was obtained from the time taken by the ions to cross between the two electrodes. In air containing 4 mg. of water per liter, both kinds of ions of short age had the same mobility of 2.0 cm.^{2}/ volt sec., while at an average age of 0.18 sec. the negative ions moved 8 per cent faster than the positive. In air partially dried by KOH, the mobility of the negative ions decreased from 2.3 (above units) at 0.004 sec. to 2.1 at 0.34 sec., while the positive ion mobility decreased from 2.0 at 0.004 sec. to 1.7 at 0.26 sec. In air dried by aid of liquid air traps, the negative ion mobility decreased from 2.44 at 0.004 sec. to 2.35 at 0.28 sec. The positive ions in this dry air were found to be very sensitive to minute changes in conditions that had no effect on negative ions. These changes are supposed to arise from small traces of some unknown impurity. Positive mobilities as high as 2.3 at 0.05 sec. were obtained.

The new information is applied to the explanation of the previous results for older ions. No transformation of one type of positive ion into another single type, as observed by Erikson, was found under the conditions of these measurements. The ions were all found to have the same mobility at the shortest ages, but with increase of time the ion mobilities became spread over a range of values, the numbers given above corresponding to the peak of the distribution curves. The nitrogen used contained 0.3 per cent of oxygen. The negative ions of short age all had a very high mobility which could only be roughly estimated as of the order of one hundred. With increase of age these fast ions gradually transformed into slower ions which were not all alike and had a peak mobility that decreased from 3.0 at 0.04 sec. to 2.5 at 0.25 sec. The fast negative ions presumably remain free electrons for a large portion of their path, and since their mobility does not appear to change with time, it is necessary to suppose that these ions alternate frequently between being free electrons and monomolecular ions, but after more molecules become attached, the ion can no longer revert to the electron stage. The positive ions in nitrogen were always contained in one group only, the peak mobility of which ranged from 2.2 at 0.007 sec. to 1.8 at 0.17 sec. The slow decrease of mobility of the ions with age and the large effect of slight changes apparently of gas composition upon the rate of this decrease for positive ions especially, indicate that the ions are gradually undergoing change of size owing to the accretion of scarce molecules or the exchange of such molecules for those which first gather about the central charge to form an ion cluster.

THE AUTHOR.

Transition Effect of Cosmic Radiation Shown by Varying the Absorbing Medium. E. Steinke. Physik. Ztschr., 1930, XXXI, 1019-1022.

A new differential method of detecting cosmic radiation is described. Measurements of the absorption coefficient for this radiation traversing Pb, Fe, Al, water, and paraffin show that Fe and the heavier elements appear to absorb anomalously; the absorption coefficient diminishes with increasing thickness, probably because of a secondary radiation excited by the cosmic radiation in the heavier atoms. An unsuccessful attempt was made to detect scattered electrons by means of a magnetic field.

CHEMICAL ABSTRACTS.

Comparison of Viscosity and Molecular Arrangement in Twenty-two Liquid Octyl Alcohols. G. W. Stewart and R. L. Edwards. Phys. Rev., Nov. 1, 1931, XXXVIII, 1575-1582.

A comparison is made between the X-ray diffraction halos of 22 octyl alcohols and their corresponding viscosities and an unmistakable correlation found. The assumptions are that the halos indicate periodicities, that the periodicities may be interpreted as structual in the "cybotactic" groups, and that the relative diffraction intensity of the halos computed by assuming crystal structure may be used to estimate roughly the perfection of the liquid groups. It thus is shown that there is a correlation between the coefficient of viscosity and the perfection of grouping in the direction of the length of the chain molecules. This corresponds with the reasonable view that the viscosity within the liquid groups is caused by longitudinal slippage. Moreover, since the groups at any instant occupy a large fraction of the volume of the liquid, this viscosity is an important part of that measured. This interpretation accounts for the negative temperature coefficient of the viscosity, since the size of the groups decrease with temperature.

The experiments and conclusions are in accord with Andrade's theory of momentary "crystallization" and with Ornstein's theory of the formation of liquid crystal groups, yet it is to be noted that these theories deal with different aspects and not the entire phenomenon.

THE AUTHOR.

The Number of γ-ray Quanta Emitted by Radium D. E. Stahel and G. J. Sizoo. Ztschr. Physik, 1930, LXVI, 741-747.

Using a special ionization chamber containing MeI, the authors measured the number of quanta emitted by Ra D and obtained the value 2.4 ± 0.7 quanta per 100 disintegrated atoms, which is in good agreement with Bramson's value of 3.1 ± 1.2.

CHEMICAL ABSTRACTS.

The Diffraction of X-rays in Organic Mixtures. Alfred Wesley Meyer. Phys. Rev., Sept. 15, 1931, XXXVIII, 1083-1093.

An examination was made by an X-ray diffraction ionization method of the following mixtures: ethyl alcohol-methylcyclohexane, butyl alcohol-ortho-dimethylcyclohexane, quinoline-phenol, paraldehyde-cyclohexane, tetranitromethane-cyclohexane, and phenol-water. All of these mixtures are totally miscible, except the last, phenol-water, which is totally miscible at higher temperatures and is an emulsion in some proportions at ordinary temperatures. In all cases of solutions the diffraction exhibits a single major peak which has an angular position between the positions of the peaks of the constituents and shifts directly with the concentration but in general not in a linear manner. There is in some cases definite indication of the existence of secondary peaks corresponding to those found in the pure constituents but these also shift. In the single case examined of an emulsion, the major peaks of both constituents were found and the intensity of each varied directly with the concentration of that constituent. The results indicate that in a solution there exists a single type of cybotactic group and that the molecules of both constituents enter this formation. The length of the most probable

space periodicity in the group depends upon the proportion of the liquids involved. The emulsion contains two types of cybotactic groups corresponding to the two constituent liquids. These conclusions suggest a very fundamental differentiation between solutions and non-solutions. This differentiation between solutions and non-solutions does not depend upon the fineness of the separation of either liquid. A solution exists when and only when the components, instead of having their individual space molecular groupings, conspire to form a single type of cybotactic group. With this description, the nature of a solution has a similarity to that of a crystal and has a definite concept.

THE AUTHOR.

Two New Methods of Interpreting Photographs Made with Convergent X-rays. O. Kratky. Ztschr. Krist., 1931, LXXVI, 517-524.

A description of two methods is given in one of which the crystal and film remain stationary, and the incident beam converges to a point on the crystal face, the angle of convergence being about 30°. The second method involves a double exposure, with a slight shift in the slit system.

CHEMICAL ABSTRACTS.

Upper Atomic-number Limits for Satellites of the X-ray Line $L\beta_2$. R. D. Richtmyer. Phys. Rev., Nov. 15, 1931, XXXVIII, 1802-1807.

The region of the X-ray spectrum in the immediate neighborhood of the line $L\beta_2$ has been photographically studied for the elements of atomic number 50, 51, 52, 53, 56, 58, and 60, with a view to determining more precisely the atomic number ranges of the satellites (five in number) of $L\beta_2$. It appears that these ranges have clearly defined upper limits in the cases of all but one of the satellites of $L\beta_2$, and that the previously supposed presence of these satellites beyond these limits, approximately atomic number 53, can be traced in some cases to certain diagram lines which had not heretofore been thoroughly investigated, and that the presence of the satellites beyond these limits is in general to be doubted, at least as far as present accuracy and sensitivity of observation are concerned. The existence and sharpness of these limits seem to be in conflict with the Wentzel-Druyvesteyn double-ionization theory of the origin of the satellites. A table of new wave lengths is included.

THE AUTHOR.

The Directional Distribution of Photoelectrons from Short Wave Roentgen Rays. Erich Lutze. Ann. Physik, 1931, IX, 853-864.

The distribution of photo-electrons liberated by short X-rays was observed with a Wilson cloud apparatus using A in the expansion chamber. The observed distribution agrees with the theory.

CHEMICAL ABSTRACTS.

A New Experiment Bearing on Cosmic-ray Phenomena. L. M. Mott-Smith and G. L. Locher. Phys. Rev., Oct. 15, 1931, XXXVIII, 1399-1408.

This new experiment consists in combining a Wilson cloud expansion apparatus with Geiger-Müller electron-counters in a manner which allows the simultaneous study of individual cosmic-ray particles by the two methods. Its purpose was to see whether the coincidence effect in electron-counters is actually caused by the passage of an ionizing particle through them as has been generally assumed. This was considered desirable because it was felt that the several conflicting cosmic-ray experiments could perhaps be more satisfactorily explained by assuming the coincidences to be produced by photons. In this work a series of expansion photographs was taken under experimental conditions which allowed a definite correlation of an ion-track appearing in

the expansion chamber with a discharge of a Geiger-Müller counter. It was found that the discharges of a counter due to cosmic radiation are accompanied by ion-tracks resembling those due to fast β-rays from radio-active sources. This result means that, in accord with previous beliefs, the coincidence effects are caused by ionizing particles. The best assumption we can make at present appears to be that these are high-energy electrons. The possibility that these effects are due to photons appears to be excluded, so that the reconciliation of the conflicting experimental data in this field will have to follow other lines.

THE AUTHOR.

Dispersion of X-rays in Calcite. Louis A. Pardue. Phys. Rev., Nov. 15, 1931, XXXVIII, 1808-1815.

The dispersion of X-ray in calcite has been investigated. The total radiation and the $K\alpha_1$ line from a molybdenum target tube operated at about 44,000 volts were used in different experiments. The decrement of unity in the index of refraction for the $K\alpha_1$ wave length was found to be $(2.001 \pm 0.009) \times 10^{-6}$. This does not agree with the value computed on the Drude-Lorentz theory. The specimen was a right prism with the optic axis parallel to the 90° refracting edge. No evidence was found for double refraction. The intensities of Mo$K\alpha_1$ radiation reflected from calcite mirrors were measured for angles in the neighborhood of the critical angle. These experimental values were compared with the values computed on the basis of Thibaud's modification of Fresnel's equation and found to be in fair agreement.

THE AUTHOR.

The Structure of Soft X-ray Lines. William V. Houston. Phys. Rev., Nov. 15, 1931, XXXVIII, 1797-1801.

The experimental work on soft X-rays has shown that the lines produced by the bombardment of a solid target are much broader than those emitted by a vapor. This is due to the fact that the upper level is not sharp. The breadth and the shape can be calculated from the various models which have been used for describing the behavior of electrons in metals. The free electron model gives a line which has a sharp edge on the short wave length side. This is not observed in Be. The calculated width, however, agrees well with the observed. The bound electron model gives a more satisfactory shape for Be, but the width cannot be exactly determined. The comparison of the line shapes calculated on the basis of these two models with that observed in Be shows that, although the free electron model gives a good approximation to the zero point energy, the distribution of energy levels is strongly affected by the periodic potential in the crystal.

THE AUTHOR.

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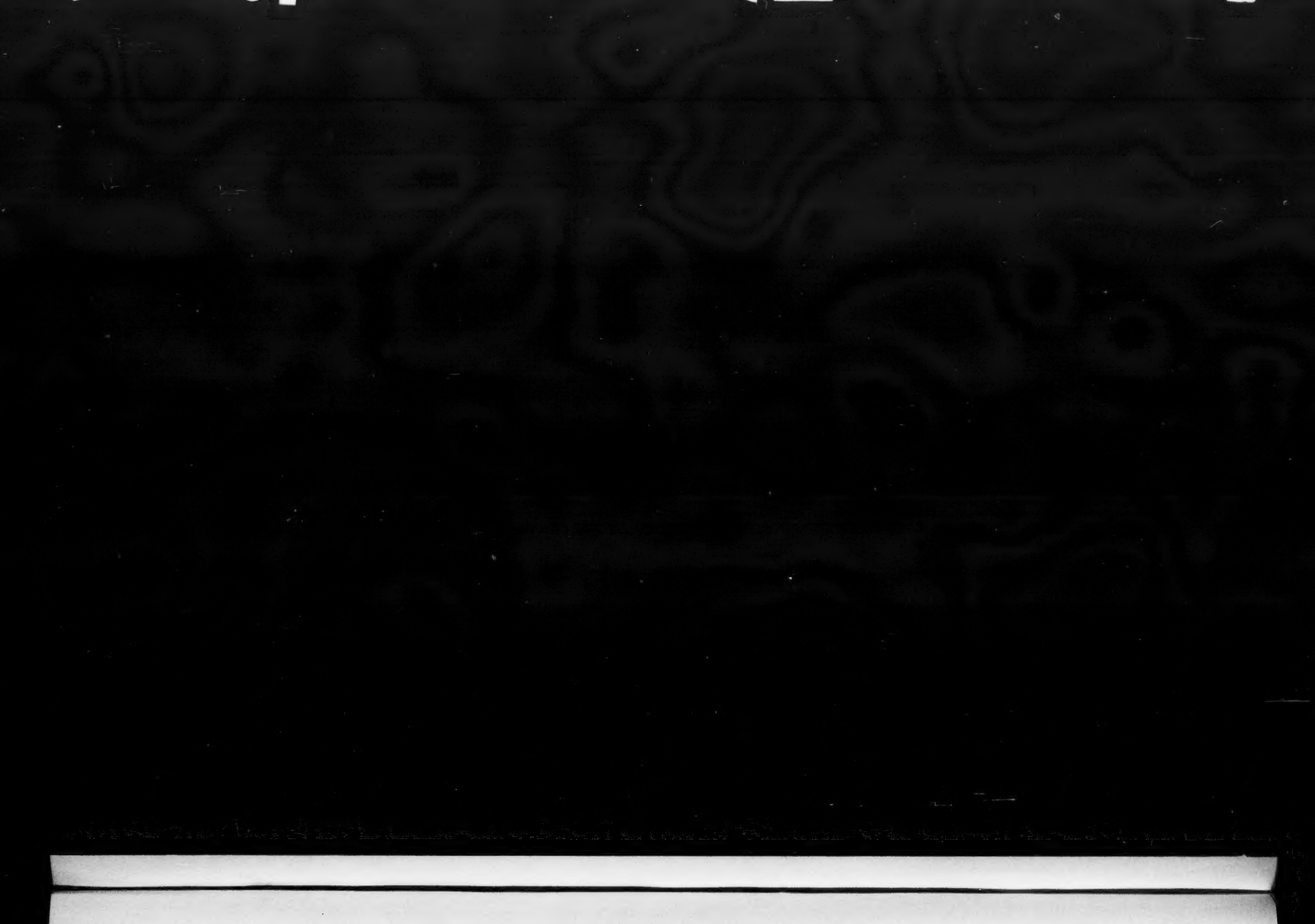
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